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SILURIAN HALYSITIDAE

OF

WESTERN CANADA

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

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ABSTRACT

Both Halysites and Catenipora are identified from the Silurian part of the Ronning group in northwestern Canada. Specimens from other parts of North America supplement the collection. Nine species and one form of Halysites and eight species and one form of Catenipora are described and illustrated. Silurian Catenipora were found to be more common than previously supposed and differ from their Ordovician counterparts in having large, oval autocorallites and moderately undulate chain outlines. Halysites can only be distinguished from them by the presence of microcorallites.

Hamada's classification of the Halysitidae is outlined and discussed. It is used on a tentative basis only as silicification of the Cordilleran specimens is probably responsible for the absence of taxonomically important septa. Halysites and Catenipora are thus the only generic names employed, all others being used in a subgeneric status. It is proposed that Hamada's Acanthohalysites be amended to include septate Halysites with complete microcorallite tabulae, and Cystihalysites for septate Halysites with vesicular microcorallite tabulae. Six species of Halysites are referred to Cystihalysites in this thesis.

Western Canadian Silurian Halysitidae are found to include both Eastern North American and Arctic Russian species. On the basis of morphologic similarity, the term "Northern Province" is used to include species of North America and Arctic Russia with European ones tentatively included also. Halysitidae of this province differ from those of the Austral-Asian Province by typically having undulating walls, large autocorallites and convex upwards microcorallite tabulae.

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CHAPTER ONE

INTRODUCTION:

The object of the present study is to identify and describe Silurian corals of the Family Halysitidae which have been collected in Western Canada. It is hoped that future workers will continue this study by establishing the stratigraphic significance of these corals through detailed field work.

Halysitoid corals, commonly referred to as "chain corals", are cosmopolitan and range from Middle Ordovician to uppermost Silurian. The present specimens were collected principally from the Silurian portion of the Romning group in northeastern British Columbia and southwestern Northwest Territories. Some specimens were also examined from the Silurian Attawapiskat formation near Hudson Bay in northeastern Manitoba, and from the Lockport dolomite in the Lake Timiskaming area of Ontario.

Of the 119 specimens in the collection, 92 are described, the other 27 being too poorly preserved or fragmentary to be identifiable. Almost all material from the Cordilleran region has been silicified.

Along with Halysites, Catenipora was found to be fairly abundant in Silurian beds. This genus was formerly thought to be mainly restricted to the Ordovician in Western Canada. The Silurian cateniporids generally differ from their Ordovician counterparts by having moderately large, oval autocorallites and chain outlines which "pinch and swell" in the same manner as the typical halysitids. During the course of the present study, Western Canadian Halysitidae were found to include a number of Arctic Russian, as well as North American species. A few species,

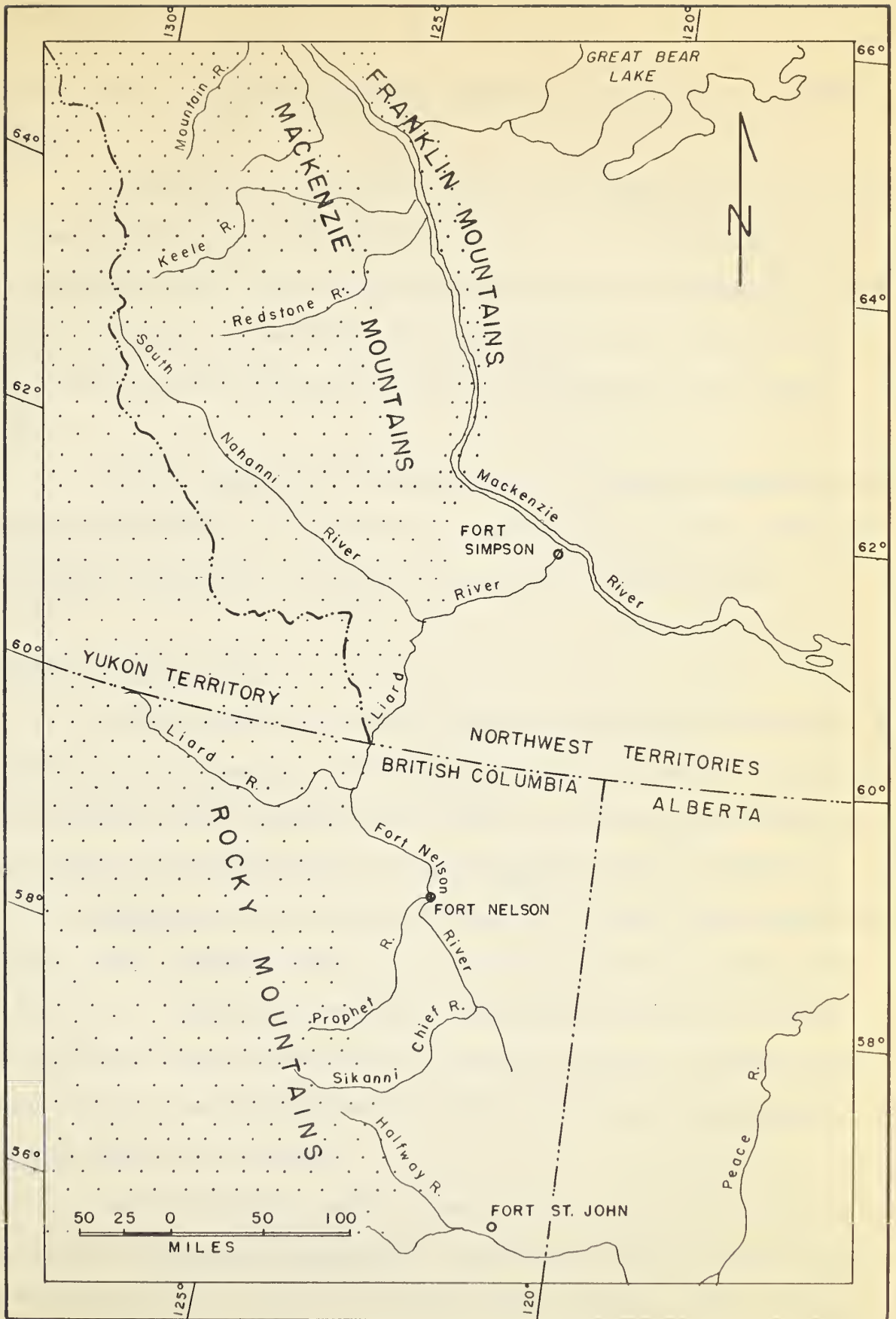


FIG.1. REFERENCE MAP OF WESTERN CANADA

particularly of the genus Catenipora, appear to be indigenous to Western Canada.

It was found that polished sections and in many cases, thin sections of both transverse and longitudinal structures were necessary for examination of these corals. The corallites are often found weathered out of the matrix, facilitating examination of growth lines on the corallite walls and imparting a three-dimensional view to corallum growth and lacunae shape.

Internal structures were examined with a binocular microscope, using magnifications of up to X32, although it was found that X4 was generally sufficient. Machinist's calipers were used for all measurements.

HISTORY OF NOMENCLATURE:

In 1767, Linnaeus described a Tubipora catenularia, not as a genus type but as a new species of this previously described genus. Fischer van Waldheim in 1813 concluded that Linnaeus' species did not belong to this genus and thus introduced the name Alyssites which he amended in 1828 to Halysites, derived from Greek meaning "a chain" (Thomas and Smith, 1954, p. 766). Buehler (1955, p. 21) pointed out that this name is invalid, but as it has been used almost exclusively by authors in favour of the earlier name, he felt that it should be retained, and added that application to the International Commission on Zoological Nomenclature to this effect will be made.

Lamarck introduced another generic name in 1816, using as his genus type, Catenipora escharoides. Lamarck was probably unaware of any previously published names for the Halysitidae (Buehler, 1955, p. 26),

as he failed to differentiate Catenipora from Halysites. Because the original descriptions of both genera were incomplete and type species were lost, later authors used the two names interchangeably and a great deal of confusion followed. In 1879, Nicholson clearly differentiated these two genera but apparently his report was not widely read, for confusion still persisted. Halysites was the more commonly used.

Thomas and Smith (1954) settled this problem by selecting neotypes and describing them in detail. They used the earlier published generic name, Halysites, for both species, H. catenularius being dimorphic (possessing auto- and microcorallites) and H. escharoides being monomorphic (possessing only autocorallites). The following year, Buehler (1955, p. 26) proposed that Halysites be used for all dimorphic species with H. catenularius as genus type (sensu Thomas and Smith, 1954). He also proposed that Lamarck's name, Catenipora, be reinstated to include all monomorphic Halysitidae with C. escharoides (sensu Thomas and Smith, 1954) as genus type. Earlier Duncan (1953, p. 1037) recognized this and referred to Catenipora as a subgenus of Halysites.

Other generic names have been added to the Halysitidae, namely Labyrinthites Lambe 1906, Cystihalysites Tchernychev 1941, and Quepora Sinclair 1955. Hamada (1957b, p. 393-405) introduced a new classification of the Halysitidae, based on three subfamilies, modifying those generic names already in use and naming five new genera, Eocateripora, Schedohalysites, Acanthohalysites, Densoporites, and Falsicatenipora. These names are defined and discussed on pages 11 to 13 of this thesis.

Tchernychev (1941, p. 57) proposed Paleohalysites, which subsequently was found conspecific with Catenipora (see Duncan, 1953, p. 1037).

Sinclair (1955, p. 97) also introduced Manipora, of Upper Ordovician age, which is monomorphic and has ranks which are only partly moniliform, others being multiple (two or more corallites in width). Sinclair was reluctant to assign this genus to the Halysitidae, pointing out that it bears affinities to Saffordophyllum, which ranges from Blackriverian to Richmondian in age. Hamada does not include this genus with the Halysitidae.

MORPHOLOGY:

Buehler (1955, p. 3-18) and Hamada (1957, p. 407-430; 1959, p. 273-289) discussed the morphology of the Halysitidae in detail. Only a summary, along with comments relevant to the morphologic features of the Western Canadian Halysitidae, is described here.

The Halysitidae are characterized by the unique arrangement of corallites into anastomosing ranks or chains resulting from the union at both ends of each corallite to two adjacent ones. These ranks are interconnected periodically with each other for structural support, producing a meshwork of varying degrees of symmetry and fineness. Tabulae are well developed and septa, when present, are spinous and generally small. The corallite walls are imperforate.

Corallum: Very few specimens examined have complete coralla. Etheridge (1904, p. 15) originally defined three corallum habits of the Halysitidae. These are: (1) hemispherical colonies in which the corallites fan out in a 180 degree arc; (2) sub-pyriform colonies in which the corallites grow upward from a narrow base in a radiating manner; (3) tabular

colonies with parallel corallites. It is quite possible that some colonies grew in an early sub-pyriform manner and later became tabular in habit. Buehler (1955, pl. 8, fig. 4) illustrated a Halysites nitidus which appears to illustrate this and Etheridge (1878, p. 582) also mentioned this habit in connection with the corallum form of H. fieldeni. Because of the fragmentary nature of most of the present specimens, the writer was not able to attach any great taxonomic significance to corallum form.

Corallites: Two different types of corallites are present in the Halysitidae: auto- and microcorallites. The former, often referred to as autopores, are the largest and are typically oval in transverse section, although in some species they are circular or angular. Auto-corallite size and shape is considered to be important taxonomically. Measurements of autocorallite size were made along the longest and shortest axes of the calyx alone, and do not include the thickness of the surrounding wall. It was found that the walls vary in thickness within a single corallum, depending on the degree of preservation at any one spot. Calyces, on the other hand, are generally intact, so that their dimensions are independent of preservation.

Microcorallites are located between the larger autocorallites in the dimorphic Halysitidae. Earlier names used are mesocorallites, mesopores and tubules. The writer has adopted the term "microcorallite" as it is accepted by Hill and Stumm (1956, p. F469) and Hamada (1958, p. 97). Microcorallites vary greatly in shape between species with rectangular, transversely elongate (long axis perpendicular to the chain

direction) or parallelogrammic (long axis parallel to the chain direction) shapes most common. Others are square, circular or irregularly shaped, the latter often characteristic of those situated at chain junctions. Commonly their outlines are concave, but this appears dependent upon their size and upon the thickness of peripheral stereozone separating microcorallites from adjacent autocorallites.

Both Etheridge (1904, p. 18-19) and Hamada (1958, p. 97) recognized a third type of corallite which the latter referred to as mesocorallite. These are located between the autocorallites at chain junctions. Hamada's reference to microcorallites is therefore restricted to those within the ranks themselves and not at the junctions. Hamada makes this distinction as a number of Australian and Southeast Asian species possess only mesocorallites and autocorallites. "Microcorallites" in the present study, refers to both the meso- and microcorallites of Hamada, since they were found to be everywhere present in dimorphic specimens of the Western Canadian Halysitidae.

The variable shape of microcorallites situated at chain junctions appears dependent on circumstance rather than genesis, and thus shape alone is not thought to warrant their distinction from the microcorallites located within the ranks. Where ranks intersect, the "fit" is often not perfect. Thus microcorallites are unusually small at junctions where the two autocorallites of the adjoining ranks are close together, or elongated where they are widely separated. "Y"-shaped microcorallites occur where chains bifurcate. Even within a corallum, many other microcorallite shapes are often present, each being dependent on the circumstance of that particular chain junction.

Tabulae: All Halysitidae have well-developed tabulae. The Western Canadian Silurian cateniporids almost invariably possess flat or gently curved, quite evenly spaced complete autocorallite tabulae, while the halysitids tend to have more irregularly spaced, often incomplete autocorallite tabulae. Hamada (1957c, p. 413-414) noted this trend also.

Microcorallite tabulae are more closely spaced than those in the autocorallites and in most Western Canadian specimens, are convex upwards. The arched microcorallite tabulae are generally complete. However, except in two species (H. infundibuliformis and H. compactus) vesicular ones were also observed, generally occurring in distinct groups within a microcorallite and not distributed uniformly amongst those tabulae which are complete (see pl. 5, fig. 5). Only H. agglomeratus (pl. 1) has predominantly vesicular microcorallite tabulae. It is interesting to note that no Australian or Southeast Asian have strongly arched microcorallite tabulae.

Septa: None of the specimens from the Cordilleran region of Western Canada were septate. The writer believes that silicification is responsible for the absence of septa. Septate Halysitidae are commonly reported from areas where the material is not recrystallized, so that it would be expected that septa were also originally present in many of the present specimens. Halysites brownsportensis, H. mirabilis, and Catenipora gotlandica, all found in Western Canada, have septate holotypes. It is strange that septa should be destroyed by recrystallization, while the delicate tabular structures remain well preserved. Possibly their chemical composition is conducive to solution. Hamada (1957a, p. 389) is of the opinion that septa are not easily destroyed, and consequently bases much of his

classification on septal structures. The writer, believing silicification responsible for their absence, is able to adopt Hamada's classification only on a tentative basis.

In the specimens from Eastern North America and the Hudson Bay Lowlands, septa are short, spinule-like, and arranged five to a side and one at both ends of each autocorallite. This has been noted by earlier workers, some of whom have reported species having long septal spinules which form or nearly form a pseudocolumella (Hamada, 1957b, p. 400). Septa generally are more strongly developed in the cateniporids than the halysitids (ibid, 1957c, p. 414).

Lacunae: The interspaces enclosed by corallite ranks and generally infilled with matrix, were termed "lacunae" by Buehler (1955, p. 7). Earlier names used were "meshes" and "fenestrules". Lacunae size and shape is one of the most striking features of the Halysitidae, and is considered to be of good taxonomic value. Their size and shape is governed by corallum habit and the sinuosity and spacing of corallite ranks. Lacunae are highly variable in shape, ranging from labyrinthine (Pl. 3, fig. 1) to square or polygonal (Pl. 8, fig. 1). Although they often vary within a single corallum, an overall pattern of size and shape is generally present.

Wall: Hamada (1957a, p. 387) was of the opinion that the Halysitidae have a three-layered wall, whereas Buehler (1955, p. 7,8) reported it to be two-layered. Most of the present material does not have original wall structures preserved. A few specimens from the Hudson Bay area and Eastern North America, however, were found to have them intact. Halysites agglomeratus (Pl. 1) has a three-layered wall. The outer layer or epitheca is finely laminated, the midwall is finely granular and the

peripheral stereozone, surrounding each autocorallite, is very thin and light coloured. Another specimen, H. brownsportensis, although lacking the same clarity of detail, appeared to have only a two-layered granular wall. Possibly, wall structure between species of the Halysitidae varies in layering and texture, or more likely, the epitheca is easily stripped off during burial or by solution action.

Silurian cateniporids generally possess a thicker wall than the halysitids. The wall separating microcorallites from autocorallites in dimorphic forms is often extremely thin (less than 0.1 mm), and composed of peripheral stereozone alone. The intercorallite walls of monomorphic forms varies considerably in thickness. In some species, (Catenipora gotlandica) it is thin, with adjacent autocorallites having flat or rounded ends, while in others (C. sp. A.), a thick wall separates commonly narrow-ended autocorallites. Wall thickness was recorded for the cateniporids alone as little taxonomic significance is indicated by the halysitid walls.

The external wall surfaces of the Halysitidae are marked by growth lines of varying intensity and spacing. Generally, the larger the corallites, the greater the distance separating these markings. Variations in spacing within a species is considerable and likely growth lines, as implied by their name, are more ecologically, than genetically controlled.

The terms "straight" and "undulate" are used in describing the outlines of the corallite ranks, the latter in place of "farcimentiform" (Etheridge, 1904, p. 17) and meaning "pinch-and-swell". North American Silurian Halysitidae differ from most Australian and Southeast Asian

species by having an undulating wall. Whereas many of the Ordovician cateniporids are straight-walled, their Silurian counterparts were found, without exception, to possess at least moderately undulate walls.

CLASSIFICATION:

The following is an outline of the classification of the Halysitidae (Hamada, 1957b; 1958), with slight modifications by the present writer.

Family Halysitidae Milne-Edwards and Haime, 1850.

Subfamily Cateniporinae Hamada, 1957

-lacking meso- and microcorallites.

Genus Labyrinthites Lambe, 1899.

Genus type and only species: Labyrinthites childensis Lambe

-angular corallites lacking septa.

Age: Upper(?) Ordovician

Genus Eocatenipora Hamada, 1957.

Genus type: Catenipora cylindrica (Wilson)

-lacking septa, corallites barely in contact.

Age: Upper Ordovician

Genus Quepora Sinclair, 1955.

Lectotype: Catenipora quebecensis (Lambe)

-lacking septa, corallites firmly in contact

Age: Middle Ordovician to Silurian(?).

Genus Catenipora Lamarck, 1816.

Genus type: Catenipora escharoides Lamarck.

-septate, corallites firmly in contact.

Age: Upper Ordovician to Upper Silurian.

Subfamily Schedohelysitinae Hamada, 1957.

-transitional Halysitidae either possessing meso- and microcorallites which are only intermittently distributed within a corallum, or possessing mesocorallites and lacking microcorallites.

Genus Schedohalysites Hamada, 1957.

Genus type: Halysites orthopteroides Etheridge

-possessing microcorallites and mesocorallites which are only intermittently distributed within a corallum; occurring only in Australia and Asia.

Age: Lower to Upper Silurian.

Genus Falsicatenipora Hamada, 1958.

Genus type: Halysites japonicus Sugiyama.

-possessing mesocorallites but lacking microcorallites.

Age: Silurian (in Australia and Asia), Upper Ordovician in Arctic Canada (Catenipora aequabilis (Teichert)).

Subfamily Halysitinae Edwards and Haime, 1850.

-possessing meso- and microcorallites.

Genus Halysites Fischer von Waldheim, 1813.

Genus type: Halysites catenularius (Linnaeus)

-meso- and microcorallite tabulae complete,
aseptate.

Age: Silurian.

Genus Cystihalysites Tchernychev, 1941.

Genus type: Cystihalysites mirabilis Tchernychev.

-possessing vesicular (dissepiment-like) meso-
and microcorallite tabulae.

Age: Middle to Upper Silurian

Genus Acanthohalysites Hamada, 1957.

Genus type: Halysites australis Etheridge

-septal spinules in autocorallites

Age: Lower (?) to Upper Silurian.

Genus Densoporites Hamada, 1957.

Genus type: Halysites compactus Rominger

-corallites united to four or six adjacent
corallites so as to form a cerioid-like
corallum with lacunae smaller than auto-
corallites.

Age: Middle Silurian.

Hamada (1957b, p. 402-403) was unaware that Cystihalysites was diagnosed as not only possessing vesicular microcorallite tabulae but also weakly developed septal spinules (Tchernychev, 1941, p. 70). It is therefore proposed that Acanthohalysites be amended to include septate

Halysitinae with complete microcorallite tabulae, and Cystihalysites for septate Halysitinae with vesicular microcorallite tabulae. Illustrations of the genus type Cystihalysites mirabilis (ibid, pl. 3, figs. 1-6) show microcorallite tabulae to be only partly vesicular, others being complete. Species of the Halysitinae which possess strongly vesicular microcorallite tabulae interspaced with complete tabulae are therefore assigned to Cystihalysites in the present study. This includes all the halysitid species of Western Canada possessing arched microcorallite tabulae except two (Halysites infundibuliformis and H. [Densoporites] compactus). Although type descriptions of most of these species do not mention vesicular microcorallite tabulae, a careful re-examination of the holotypes would possibly determine their presence.

The writer has employed Hamada's classification on a tentative basis only. As previously pointed out, the aseptate nature of specimens from the Ronning group is probably due to destruction by silicification. As a result, the distinction of Acanthohalysites from Halysites, and Quepora from Catenipora (sensu Hamada, 1957) is unreliable. The writer has thus employed the generic names Halysites and Catenipora (sensu Buehler, 1955) alone, using those proposed by Hamada and other authors as subgenera.

Figures 2 and 3 include scale drawings of the species of Western Canadian Halysitidae. Subgeneric names are omitted for the sake of brevity.

(A) <i>H. magnitubus</i> Buehler forma 1	X1	X1	Lacunae: irregular, up to 7 by 16 mm. Autocorallites: oval to circular, approx. 3.2 X 4.0 mm. Microcorallites: parallelogrammic, 1.0 X 2.0 mm. Autocorallite tabulae: flat or concave upward. Microcorallite tabulae: convex up, partly vesicular.
(B) <i>H. latus</i> Tchernychev	X1	X1	Lacunae: variable, often oval, up to 11 X 38 mm. Autocorallites: oval, approx. 2.2 X 2.9 mm. Microcorallites: rectangular, 1.1 X 0.6 mm. Autocorallite tabulae: flat. Microcorallite tabulae: convex up, partly vesicular.
(C) <i>H. mirabilis</i> Tchernychev	X1	X1	Lacunae: irregular or labyrinthine, up to 7 X 22 mm. Autocorallites: mainly circular, up to 1.8 X 2.0 mm. Microcorallites: rectangular, 0.8 X 0.3 mm. Autocorallite tabulae: flat. Microcorallite tabulae: convex up, partly vesicular.
(D) <i>H. brownsportensis</i> Amsden	X1	X1	Lacunae: labyrinthine, up to 10 X 25 mm. Autocorallites: oval, approx. 1.6 X 2.1 mm. Microcorallites: rectangular, 0.9 X 0.4 mm. Autocorallite tabulae: concave upward. Microcorallite tabulae: convex up, partly vesicular.
(E) <i>H. nexus</i> Davis	X1	X1	Lacunae: unclosed, parallel ranks. Autocorallites: oval, up to 1.9 X 2.5 mm. Microcorallites: rectangular, 0.7 X 0.5 mm. Autocorallite tabulae: flat. Microcorallite tabulae: convex up, partly vesicular.
(F) <i>H. infundibuliformis</i> Buehler	X1	X2	Lacunae: labyrinthine, up to 7 X 30 mm. Autocorallites: oval, approx. 0.9 X 1.7 mm. Microcorallites: parallelogrammic or square, small. Autocorallite tabulae: concave upward. Microcorallite tabulae: convex up, complete.
(G) <i>H. agglomeratus</i> Hall	X1	X2	Lacunae: very narrow, abutting ranks. Autocorallites: oval or circular, approx. 1.3 X 1.9 mm. Microcorallites: commonly square, 0.5 mm across. Autocorallite tabulae: concave upward or flat. Microcorallite tabulae: convex up, vesicular.
(H) <i>H. compactus</i> Rominger	X1	X2	Corallum: similar to ceroid colony. Autocorallites: variable shape, 1.0 to 1.5 mm diam. Microcorallites: small, sporadically developed (?). Autocorallite tabulae: mainly flat. Microcorallite tabulae: convex up, complete.
(I) <i>H. sp. cf. H. catenularius</i> (Linnaeus)	X1	X2	Lacunae: variable, up to 5 X 12 mm. Autocorallites: oval, average 1.4 X 1.9 mm. Microcorallites: often square, 0.2 mm across. Autocorallite tabulae: flat. Microcorallite tabulae: flat, complete.
(J) <i>H. sp. cf. H. süssmilchi</i> Etheridge	X1	X4	Lacunae: variable, up to 4 X 12 mm. Autocorallites: oval, approx. 0.8 X 1.0 mm. Microcorallites: square, 0.2 mm across. Autocorallite tabulae: flat. Microcorallite tabulae: flat, complete.

Fig. 2. Diagrams and brief descriptions of species of Halysites in Western Canada




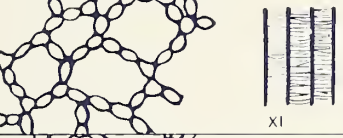
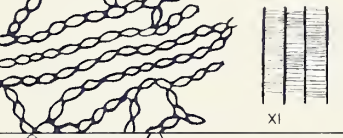
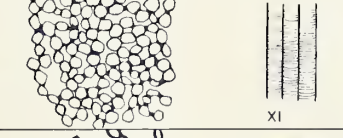

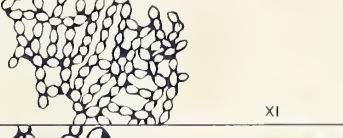

<p>(A)</p> <p><i>C. gatlandica</i> (Yabe)</p>		<p>Lacunae: rectangular, up to 3 by 21 mm</p> <p>Autacarrallites: oval or circular, up to 2.3 by 3 mm</p> <p>Tabulae: concave upward, variably spaced</p> <p>Wall: approx 0.15 mm. thick</p>
<p>(B)</p> <p><i>C. sp.</i>, cf. <i>C. simplex</i> (Lambe)</p>		<p>Lacunae: labyrinthine or irregular, up to 15 by 30 mm.</p> <p>Autacarrallites: oval, approx. 1.2 by 1.7 mm.</p> <p>Tabulae: concave upward, or flat</p> <p>Wall: approx. 0.2 mm. thick</p>
<p>(C)</p> <p><i>C. n. sp. 1.</i></p>		<p>Lacunae: commonly rectangular, up to 3 by 13 mm</p> <p>Autacarrallites: oval, averaging 1.2 by 1.8 mm</p> <p>Tabulae: flat</p> <p>Wall: approx. 0.2 mm. thick</p>
<p>(D)</p> <p><i>C. n. sp. 1. forma 1</i></p>		<p>Lacunae: commonly polygonal, up to 8 by 17 mm.</p> <p>Autacarrallites: oval, approx 1 by 2 mm.</p> <p>Tabulae: flat or concave upward</p> <p>Wall: approx 0.2 mm thick</p>
<p>(E)</p> <p><i>C. sp. A.</i></p>		<p>Lacunae: long and narrow, 3 mm in width</p> <p>Autacarrallites: oval, approx 0.9 by 1.7 mm</p> <p>Tabulae: flat</p> <p>Wall: approx 0.3 mm. thick</p>
<p>(F)</p> <p><i>C. irregularis</i> (Teichert)</p>		<p>Lacunae: generally less than 1 mm in width</p> <p>Autacarrallites: oval or circular, 1 to 1.5 mm. diam.</p> <p>Tabulae: flat or concave upward</p> <p>Wall: approx 0.1 mm thick</p>
<p>(G)</p> <p><i>C. sp.</i>, cf. <i>C. pulchella</i> (Wilson)</p>		<p>Lacunae: labyrinthine or irregular, approx 3 by 10 mm.</p> <p>Autacarrallites: oval, approx 0.6 by 1 mm</p> <p>Tabulae: flat</p> <p>Wall: varies from 0.1 to 0.25 mm thick</p>
<p>(H)</p> <p><i>C. sp. B.</i></p>		<p>Lacunae: rectangular, 1 by 4 mm</p> <p>Autacarrallites: oval, approx. 0.7 by 1.2 mm.</p> <p>Tabulae: not preserved</p> <p>Wall: approx 0.1 mm. thick</p>
<p>(I)</p> <p><i>C. sp. C.</i></p>		<p>Lacunae: ranks nearly abut, 3 mm is greatest width</p> <p>Autacarrallites: oval, approx 1 by 1.6 mm.</p> <p>Tabulae: flat</p> <p>Wall: approx 0.2 mm. thick on corallite sides</p>

Fig. 3. Diagrams and brief descriptions of species of Catenipora in Western Canada

FAUNAL ASSOCIATIONS:

The Silurian Halysitidae appear to lie in two or possibly three faunal provinces. One, which is here termed the Northern Province, includes North American and Arctic Russian species. The second, called the Austral-Asian Province (modified from Hamada, 1958, p. 92) includes Australian and Southeast Asian species. Finally, European species may either lie in a third province, or be included with the Northern Province. As will be later explained, the writer prefers the latter possibility.

The Northern Province has Halysitidae usually characterized by undulating walls, large autocorallites (greater than 1.5 mm in length), and convex upwards microcorallite tabulae. Four species (Halysites brownsportensis, H. infundibuliformis, H. nexus and H. compactus) are common to Eastern and Western North America, and three (Halysites mirabilis, H. latus and H. compactus) to Russia and Western North America. In addition, the Arctic Russian species Halysites mirabilis and H. latus closely resemble the North American H. brownsportensis and H. magnitubus, respectively.

The European Halysitidae are tentatively included in the Northern Province as they also commonly have large autocorallites, arched microcorallite tabulae and undulating walls. Halysites labyrinthicus and H. brownsportensis may be conspecific with the European H. catenularius (sensu Thomas and Smith, 1954) and H. cavernosus, respectively. One European species (Catenipora gotlandica) was found in Western Canada.

The Halysitidae of the Austral-Asian Province differ considerably from those of the Northern Province. Typically they have

small (less than 1.5 mm in length) rectangular autocorallites, straight walls and flat microcorallite tabulae. Only one species (Halysites sp., cf. H. süssmilchi) from Western Canada bears an affinity to species of this faunal province.

CHAPTER TWO

STRATIGRAPHY:

The Halysitidae range from Middle Ordovician to uppermost Silurian. Weissermel in Turkey (see Hamada, 1957c, p. 419, 421) and Clarke in North America (ibid) both reported chain corals from Geninnian deposits (Lower Devonian) but most workers discredit this and do not consider Halysitidae to be younger than Silurian.

Hamada (1957c, p. 407-425) discussed in detail chronogenesis of the Halysitidae, pointing out that the Halysitinae are restricted to the Silurian, reaching their maximum development during Middle Silurian time. The Cateniporinae, however, range from the Middle Ordovician to the end of the Middle Silurian, being most prolific in Richmondian and Middle Silurian times.

Silurian cateniporids (Duncan, 1956, p. 223; Hamada, 1957c, p. 411) have fairly large, oval, autocorallites in contrast to the typically small, often rectangular autocorallites of their Ordovician counterparts.

The majority of the present specimens are from the Silurian portion of the Ronning group, in northeastern British Columbia and southwestern Northwest Territories. As they were not collected by the writer, little is known concerning their field relationships. Systematic and extensive collecting along with detailed field information will be necessary in order to establish the true stratigraphic significance of the Western Canadian Halysitidae. Only generalities which are evident from the stratigraphic information available is attempted here.

The Ronning group outcrops from the Peace River area in the eastern Cordillera of northeastern British Columbia, north into the Mackenzie and Franklin Mountains of the Mackenzie River basin. Dolomites dominate lithologically, but locally limestones are present, particularly in the Northwest Territories. In the South Nahanni River area, Middle Silurian graptolitic shales have apparently replaced the carbonate facies (see Cameron and Warren, 1938, p. 18). In the Northwest Territories, the Ronning is underlain by Cambrian quartzites and argillites of the McDougal group, and overlain (only as far south as Fort Wrigley) by Devonian(?) brecciated or non-bedded unfossiliferous dolomites of the Bear Rock formation. Hume (1953, p. 19) placed three formations in the Ronning group. In ascending order, these are the massive, vuggy, unfossiliferous Franklin Mountain, the well-bedded, cherty, fossiliferous Mount Kindle, and the limy and dolomitic, unfossiliferous Lone Mountain formations. Hume considered these Lower, Middle, and Upper Silurian, respectively.

Borden (1956) reported Upper Ordovician corals from the Mount Kindle formation, and concluded that only the upper part of this formation is of Silurian age. On stratigraphic position Bell (1959, p. 12) stated that the Franklin Mountain is Lower or Middle Ordovician. This formation is widespread in the Northwest Territories, but in British Columbia, if not absent, is only present locally. Ordovician beds have been identified in northeastern British Columbia but these are likely lower Mount Kindle.

The Lone Mountain formation, which outcrops from Fort Wrigley south to the Peace River is now thought to be Devonian. Recent workers generally separate the Lone Mountain from the Ronning because of faunal

and lithologic differences. The contact, at least in northeastern British Columbia, is apparently conformable.

The Halysitidae of this thesis are apparently from only the upper Mount Kindle. However, because of the paucity of information concerning the Ordovician and Silurian beds of Western Canada, the material examined is referred to as being from the Silurian Ronning, rather than specifically from the upper Mount Kindle.

The Mount Kindle formation is widespread throughout the Mackenzie River basin and northeastern British Columbia. In the latter area, Ordovician beds are present only locally. Here, a white, well sorted and rounded sandstone, probably indicative of shallow seas and possibly a major hiatus, occurs near the Ordovician-Silurian boundary. These beds may be diachronic since basal Silurian Pentamerid beds, where found, lie either above or below (but always close to) them in different sections. Ordovician fossils, however, have not yet been reported from above the sandstones.

The Mount Kindle, as will be later discussed, almost certainly contains Middle Silurian beds. There is, however, no definite evidence for the presence or absence of the Lower Silurian. If the sandstones in British Columbia represent a major break, then this would probably include the Lower Silurian, especially where Upper Ordovician fauna are below the sandstones. To the writer's knowledge, there is no such break in the Northwest Territories. The presence of Upper Silurian is also uncertain. The Lone Mountain, as earlier mentioned, is apparently conformable with the Ronning group. North of Wrigley where the Bear Rock overlies the Ronning, the contact is disconformable.

Figure 4 illustrates the relative stratigraphic positions of all specimens from the Silurian Ronning group for which there was available field information. Its accuracy is dependent upon time equivalence of the upper and lower contacts between sections of the Silurian Ronning group. Thickness of the group varies considerably; from 600 to greater than 2000 feet in northeastern British Columbia. A transgressive hiatus if present at the base of the Silurian in British Columbia, would account for this large variation in thickness. This would greatly distort relative faunal positions. Although pentamerid beds are taken as basal Silurian, hundreds of feet may separate them from the nearest underlying Ordovician fauna, with the Ordovician-Silurian contact lying anywhere between. The sandstone beds have been used in some sections as basal Silurian, but as earlier mentioned, they may be diachronic. Nevertheless this contact is probably relatively accurate. Where lacking any other means, Silurian-like cateniporids are used as the contact. This is the case with some sections in the Northwest Territories.

General trends in stratigraphic position are indicated by the Halysitidae. Halysites brownsportensis ranges through the Silurian Ronning. Halysites infundibuliformis lies in the lower Silurian Ronning in northeastern British Columbia and the middle and upper Silurian Ronning of the Northwest Territories, suggesting that the Ronning group is transgressive from north to south. All cateniporids (except C. n. sp. 1 forma 1) and Halysites sp., cf. H. süssmilchi are found in the lower portion of the Silurian Ronning.

Halysites brownsportensis, H. infundibuliformis, H. nexus, H. magnitubus and H. compactus all have been reported from Middle Silurian

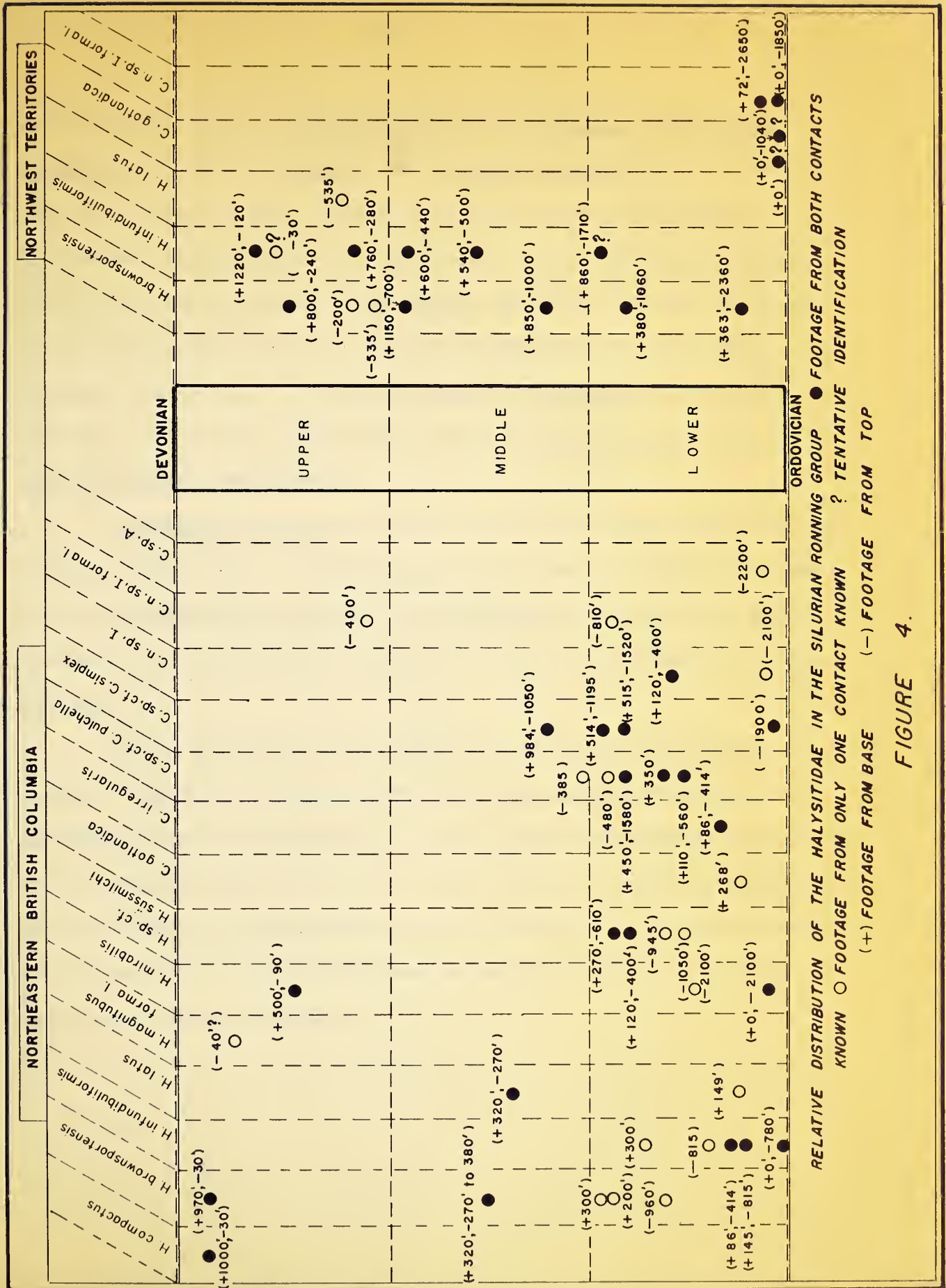


FIGURE 4.

beds (Bassler, 1950). Halysites latus and H. mirabilis, Catenipora gotlandica, C. aff. C. simplex, and Halysites compactus are all reported from Arctic Russian Upper Silurian beds (Tchernychev, 1937; 1941). In the Ronning, these species occur with other species of Middle Silurian age so that they may either range through the Middle and Upper Silurian, or the Arctic Russian beds may actually be Middle rather than Upper Silurian. As earlier mentioned, H. lata and H. mirabilis are closely related to the Middle Silurian North American H. magnitubus and H. brownsportensis, respectively.

Catenipora pulchella was named from rocks of Upper Ordovician age (Wilson, 1926, p. 15). If this species ranges into the Middle Silurian as is here indicated by C. sp., cf. C. pulchella, it is the only known species of the chain corals known to transgress the Ordovician-Silurian boundary.

Before the value of the Silurian Halysitidae as precise age indicators can be fully appreciated, more stratigraphic collecting is necessary elsewhere to establish the true ranges of individual species. It is unfortunate that the Silurian faunal record is generally incomplete in North America. Perhaps this will not be the case in the Soviet Union. If they are able to zone their fauna in detail, correlations to North America will not be difficult.

CHAPTER THREE

INTRODUCTION:

Nine species and one form are herein described for the genus Halysites and eight species and one form for Catenipora. Where possible, holotypes were obtained and described.

Specimen numbers preceeded by "U. of A." are on repository in the Department of Geology, University of Alberta, Edmonton. Specimens listed by number alone are stored at the California Standard Company, Edmonton.

FORMAL DESCRIPTIONS:

Phylum COELENTERATA

Subphylum CNIDARIA

Class ANTHOZOA

Subclass ZOANTHARIA

Order TABULATA

Family HALYSITIDAE Edwards and Haime, 1850

Subfamily HALYSITINAE Edwards and Haime, 1850, emend.

Genus HALYSITES Fischer von Waldheim, 1813

HALYSITES [Cystihalysites] AGGLOMERATUS Hall, 1843.

Pl. 1 Figs. 1-6, Text fig. 2G

Halysites agglomerata Hall, 1843, Nat. History of New York, Pt. 4, pl. 22, fig. 2; HALL, 1852, Nat. History of New York, Pt. 6, Paleontology of New York, pt. 2, p. 127-129, pl. 35; BUEHLER, 1955, Yale Peabody Mus. Nat. History, Bull. 8, p. 35-36, pl. 4, figs. 2-4.

Description of Lectotype: The corallum is sub-pyriform, incomplete, measuring 7.5 cm. by 11.0 cm. with 2.5 cm. of vertical growth present.

Transverse section: The chains are parallel, straight to meandering with 5 to 8 corallites per chain. Corallite outlines are strongly undulate. Adjacent chains commonly abut so that lacunae are very narrow in parts of the corallum. Autocorallites are circular or oval, measuring 1 to 1.2 mm. in width by 1.2 to 1.4 mm. in length. Since a polished or thin section was not available, shape and size of microcorallites could not be definitely established. However, strongly undulate corallite walls suggest that they are small, square to transversely elongate and measure no more than 0.5 mm. across. No septa were observed.

Longitudinal section: Corallite walls have closely spaced growth lines. Only a few autocorallite tabulae are visible, being flat to gently concave upwards. Those of the microcorallites are apparently complete(?), strongly convex upwards and closely spaced.

Description of "Lectoparatype": The "lectoparatype" differs from the lectotype in having a tabular corallum (possibly the distal portion of a more mature colony). Tabulae are better displayed than in the lectotype, and are also similar, with those in the autocorallites concave upwards and those in the microcorallites convex upwards.

Description of Figured Specimen U. of A. No. 1132:

The corallum is tabular, incomplete with the surface measuring 2.5 cm. by 4.7 cm. and with 4.5 cm. of vertical growth present.

Transverse section: The chains are parallel, straight to gently meandering and commonly abut. Up to 11 corallites composed a rank. Corallite outlines are moderately undulate. Lacunae are very narrow except where a slight temporary divergence of chains occurs. Auto-

corallites are either circular, measuring 1.4 mm. in diameter, or oval, measuring 1.3 mm. in width by 1.9 mm. in length. Microcorallites are nearly square and are 0.5 mm. across. Twelve septal spinules are present in each autocorallite, arranged 5 to a side and 1 at both ends. They are thin, needle-like, short, and no more than 0.15 mm. long.

Longitudinal section: Corallite walls possess two sets of well defined growth lines; fine and very closely spaced, and coarse and widely spaced (0.7 mm. apart). Autocorallite tabulae are thin, complete, flat or concave upwards and 0.2 mm. to 0.4 mm. apart. Microcorallite tabulae are mainly vesicular, closely spaced, and strongly convex upwards.

Material and Location:

Lectotype, Am. Mus. Nat. History No. 1690, 2:1. Till boulder(?) from either Niagara limestone or Guelph dolomite. Near Sweden, Monroe County, New York.

"Lectoparatype", Am. Mus. Nat. History No. 1690 2:2. No stratigraphic or geographic location, probably from same area as lectotype.

Figured specimen U. of A. No. 1132. Stromatoporoidal bioherm in the Attawapiskat formation (Niagarian). Two miles south of Cape Churchill on the tidal flats along Hudson Bay, northeastern Manitoba.

One other specimen (U. of A. No. 1131), from the same formation as the figured specimen. Approximately two miles further south.

Remarks: Hall described this species from two syntypes; Am. Mus. Nat. History No. 1690 2:1 and No. 1690 2:2. Buehler (1955, p. 36) raised the former syntype to lectotype status. The writer refers to the latter syntype, No. 1690, 2:2 as "lectoparatype", enclosing this term in quotation marks as it has not been formally defined. The illustration

of the "lectoparatype" in Buehler (1955, pl. 4, fig. 2) is inverted.

The figured specimen differs from the lectotype in possessing highly vesicular microcorallite tabulae and slightly larger septate autocorallites. It was not possible to establish whether septa are present in lectotype since thin or polished sections were unavailable.

Halysites agglomeratus is distinguished by the closely spaced, often abutting chains and the commonly circular autocorallites. If septal spinules are present in the lectotype, then H. catenularius var. longicatenatus Weissermel (see Hamada, 1957, p. 419) would most likely be conspecific with it.

To the writer's knowledge, no specimens of H. agglomeratus have been reported from the Canadian Cordillera.

Associated Fauna:

Figured specimen U. of A. No. 1132: Favosites niagarensis lundarensis Stearn and Clathrodictyon sp.

U. of A. No. 1131: Clathrodictyon sp.

HALYSITES [CYSTIHALYSITES] BROWNSPORTENSIS Amsden, 1949.

Pl. 2 Figs. 1-6; Text fig. 2D

Halysites catenularia brownsportensis AMSDEN, 1949, Peabody Mus. Nat. History, Bull. 5, p. 94-95, pl. 18, figs. 1-3.

Halysites brownsportensis Amsden, BUEHLER, 1955, Peabody Mus. Nat. History, Bull. 8, p. 65-66, pl. 9, figs. 4-6; pl. 10, fig. 6.

Halysites [Cystihalysites] brownsportensis Amsden. DUNCAN, 1956, U.S. Geol. Surv. Bull. 1021-F, p. 222, pl. 27, figs. 3a-3c.

Cystihalysites brownsportensis (Amsden). HAMADA, 1957, Jour. Faculty Sci., Tokyo Univ., sec. 2, v. 10, pt. 3, p. 403-404.

Description of Holotype: The corallum is gently sub-pyriform, incomplete, large, measuring 10.5 cm. by 16 cm. with 8 cm. of vertical growth present.

Transverse section: The chains anastomose in a sub-parallel, generally meandering manner and have a variable number of corallites, the observed range being 2 to 12 per chain. Corallite outlines are highly undulate. Lacunae are typically labyrinthine but may also be rectangular, sub-polygonal or irregular in shape measuring 2 to 9 mm. in width and up to 50 mm. in length. A typical width is 3 mm. but the length is highly variable. Autocorallites are oval, 1.5 mm. in width by 2.0 mm. in length. Microcorallites are either square or transversely elongate, measuring 0.2 to 0.4 mm. No septa were observed.

Longitudinal section: Corallite walls possess well defined, closely spaced growth lines, at 0.5 mm. intervals. Autocorallite tabulae are flat to gently concave upwards, generally complete and about 0.2 mm. apart. Microcorallite tabulae are strongly convex upwards, complete or vesicular and closely spaced.

Description of Figured Specimen U. of A. No. 1130:

The corallum is tabular, incomplete, with the surface measuring 4.5 cm. in diameter and with 3.5 cm. of vertical growth present.

Transverse section: The chains meander in a sub-parallel manner and are composed of a variable number of corallites, the observed range being from 1 to 10 per chain. Corallite outlines are moderately undulate. Lacunae are highly labyrinthine, measuring from 3 to 10 mm. in

width and 13 to greater than 25 mm. in length. Autocorallites are oval, moderately large, typically 1.6 mm. wide and 2.1 mm. long. Microcorallites are rectangular, transversely elongate and measure 0.9 mm. by 0.4 mm. No septa were observed.

Longitudinal section: External wall surfaces are not visible. Autocorallite tabulae are thin, complete, gently concave upwards to occasionally flat and about 0.3 mm. apart. Microcorallite tabulae are complete to partly vesicular, strongly convex upwards and very closely spaced.

Material and Location:

Holotype, Yale Peabody Mus. No. 17638. Brownsport formation (Middle Silurian). Western Tennessee.

Figured specimen U. of A. No. 1130. Ronning Group (Silurian), 270'-380' below the top and 320' above the base of the quartzite. About 20 miles north of Tuchodi Lakes, British Columbia, 58° 29' N., 124° 31' W.

Eighteen other specimens were examined (see appendix for numbers). Fifteen from Ronning Group in British Columbia and Northwest Territories, ranging in both areas from lower- to uppermost Silurian beds present. One from the Middle Silurian Attawapiskat formation near Fort Churchill, Manitoba. Two from the Middle Silurian Lockport formation in Ontario and New York State.

Remarks: The figured specimen differs from the holotype in possessing slightly larger autocorallites and microcorallites which are entirely transversely elongate. Septal spinules, present in parts of the holotype (Amsden, 1949, p. 94) are absent in the figured specimen, probably because of silicification. One of the specimens examined (U. of A. No. 1173) from the Hudson Bay Lowlands, was not recrystallized and possessed small septal spinules in many of the autocorallites. Buehler's hypotype

H. brownsportensis (1955, pl. 10, fig. 6) has not the elongate, labyrinthine lacunae typical of the holotype. Four of the writer's specimens, however, possesses fenestrules similar to this hypotype.

Halysites brownsportensis is one of the commonest Silurian halysitids in Western Canada. It has also been reported from the United States Cordillera (Duncan, 1956, pl. 27). It is distinguished by its labyrinthine lacunae, medium sized autocorallites and arched microcorallite tabulae, the latter feature serving as the only distinguishing characteristic of H. brownsportensis from H. labyrinthicus (Goldfuss) (Buehler, 1955, p. 29-30). Halysites brownsportensis differs from H. magnitubus Buehler by having smaller autocorallites; from H. nexus Davis by the labyrinthine, closed lacunae; and from H. infundibuliformis Buehler by the larger autocorallites and less strongly radiate corallum growth.

Associated fauna:

No. 1128: Catenipora irregularis (Teichert), C. n. sp. 1 and Halysites nexus Davis.

U. of A. No. 37554: Favosites gothlandicus Lamarck.

No. 1144: Halysites compactus Rominger.

HALYSITES [DENSOPORITES] COMPACTUS Rominger, 1876.

Pl. 2 Figs. 7-10 Text fig. 2H

Halysites compactus Rominger, 1876, Rept. of the Geol. Survey Michigan, Lower Peninsula, v. 3, pt. 2, p. 78-79, pl. 29; LAMBE, 1899, Contr. to Canadian Palaeontology, v. 4, pt. 1, p. 71-73, 78, pl. 14, figs. 5-8; TCHERNYCHEV, 1937, Trans. Arctic Instit. Leningrad, v. 91, p. 97-98, pl. 12, figs. 4-6, text fig. 1; BUEHLER, 1955, Peabody Mus. Nat. History, Bull. 8, p. 41-42, pl. 4, figs. 5,6; pl. 5, figs. 2,3.

Densoporites compactus (Rominger). HAMADA, 1957, Jour. Faculty Sci. Tokyo Univ. Sec. 2, v. 10, pt. 3, p. 404-405.

Description of Figured Specimen No. 1144:

The corallum is nearly complete, hemispherical, with the surface measuring 5 cm. by 5.5 cm. and with corallites 2 cm. long. The overall appearance of the corallum is very similar to a cerioid colony.

Transverse section: Normally each corallite is joined by a narrow point of contact to four to six adjacent ones. Their outlines are square, hexagonal or polygonal. Lacunae are very small, rarely larger than 1 mm. Proximally corallites are less densely packed, and more commonly chains of two corallites were observed with fenestrules up to 2 mm. in width and 4 mm. in length. Throughout the colony, autocorallites are either oval, nearly circular, square or polygonal, measuring 1 to 1.5 mm. in diameter. Microcorallites, owing to poor preservation, are difficult to detect, but appear to be only sporadically developed. They are small, square to transversely elongate, measuring up to 0.6 mm. by 0.4 mm. No septa were observed.

Longitudinal section: Corallites exhibit strongly radiate growth. Autocorallite tabulae are complete, flat to occasionally gently concave upwards and 0.2 to 0.4 mm. apart. Microcorallite tabulae are mainly complete, convex upwards and very closely spaced.

Material and Location:

Figured specimen No. 1144. Ronning group (Silurian), 30' below the top and 1,000' above lowermost Silurian fauna. 5 miles west of Mt. Berth on the Sikanni Chief River, British Columbia.

Remarks: It is quite possible that *H. compactus* is more abundant in Western Canada than is indicated by this solitary specimen. Its striking similarity superficially to a cerioid colony could easily have resulted in its misidentification as *Favosites* or a related genus.

The figured specimen differs only from the lectotype (Buehler, 1955, p. 42) in having slightly smaller autocorallites.

Halysites compactus is distinguished by its densely packed corallites lacking a chain-like orientation. It is closely related to the Australian species H. brevicantenatus Hill (1954, p. 38) but has larger and more densely packed autocorallites. Hill (ibid), in her holotype description stated that "these tubules, [microcorallites], are crossed by tabulae as in the normal autocorallites", implying that they are also "slightly sagging" as compared to the strongly convex upwards microcorallite tabulae of H. compactus. From Catenipora irregularis (Teichert) and the genus Labyrinthites Lambe, H. compactus can be distinguished by microcorallites being present and by the more densely packed autocorallites.

Associated fauna:

Figured specimen No. 1144: Halysites brownsportensis Amsden.

HALYSITES INFUNDIBULIFORMIS Buehler, 1955

Pl. 3 Figs. 1-6, Text fig. 2F

Halysites infundibuliformis BUEHLER, 1955, Peabody Mus. Nat. History, Bull. 8, p. 67, pl. 1; pl. 2; pl. 3, fig. 6.

Description of Holotype: The specimen is a very well preserved corallum with flaring corallites originating from a small base. The upper surface

measures 4 cm. by 6.5 cm. with corallites up to 4 cm. tall.

Transverse section: The chains anastomose in a sub-parallel, highly sinuous manner and have up to 15 corallites. Corallite outlines are moderately undulate. Lacunae are highly labyrinthine and increase in size distally. The largest lacuna observed is 7 mm. wide and 30 mm. long. Autocorallites are oval and average 0.9 mm. in width by 1.4 mm. in length. Microcorallites are parallelogrammic or square, measuring 0.2 mm. by 0.2 to 0.5 mm. No septa were observed.

Longitudinal section: The corallite walls have fine, closely spaced growth lines. Autocorallite tabulae are gently concave upwards, mainly complete and 0.2 to 0.5 mm. apart. Microcorallite tabulae are convex upwards, mainly complete and closely spaced.

The corallum is hemispherical in shape, small, almost complete, the surface measuring 5.5 cm. by 6.5 cm. and with approximately 2.5 cm. of vertical growth present.

Description of Figured Specimen U. of A. No. 37507

Transverse section: The chains anastomose in a moderately straight or gently meandering pattern and typically are composed of 2 to 3 corallites. Corallite outlines are moderately undulate. Lacunae are rectangular, irregular or gently labyrinthine, from 2 to 3.5 mm. in width by 8 to 15 mm. in length. Autocorallites are oval, rarely circular, and are typically 1.2 mm. in width by 1.5 to 1.7 mm. in length. Microcorallites are rectangular, transversely elongate and measure 0.4 mm. by 0.1 mm. No septa were observed.

Longitudinal section: Corallite walls have sharp, variably spaced growth lines. Autocorallite tabulae are mainly complete, flat

to occasionally gently concave upwards and about 0.3 mm. apart. Microcorallite tabulae are complete, convex upwards and about 0.2 mm. distant.

Material and Location:

Holotype, Yale Peabody Mus. Nat. History No. 19142. In glacial drift, likely from Lockport dolomite (Middle Silurian). 7 miles northwest of Genesee at York, New York.

Figured specimen U. of A. No. 37507. Ronning group (Silurian), 500' below the top and 540' above lowermost Silurian fauna. Wrigley Lake, Northwest Territories, 63° 53' N., 126° 12' W.

Fifteen other specimens from the Ronning rroup (see appendix for sample numbers). Six from British Columbia, five from the lower portion of the Silurian beds, one unlocated. Nine from the Northwest Territories, one from the uppermost-lower and five from the middle and upper part of the Silurian beds, three unlocated.

Remarks: The figured specimen differs from the holotype in having generally narrower and less labyrinthine lacunae, autocorallite tabulae which often are flat, and transversely elongate microcorallite tabulae.

Halysites infundibuliformis is one of the commonest halysitid species examined by the writer. It is distinguished by its radiate corallites, autocorallite size and lacunae pattern. Buehler (1955, p. 67) pointed out that it differs from H. labyrinthicus (Goldfuss) in the radiating corallites and infundibuliform lacunae but Buehler's figure of H. labyrinthicus shows this radiating habit also (ibid, pl. 3, fig. 2). Possibly the best distinguishing criteria are the arched microcorallite tabulae and generally smaller autocorallites of H. infundibuliformis. It differs from H. brownspontensis Amsden, by the generally non-vesicular microcorallite tabulae, slightly smaller auto-

corallites and strongly radiate growth. From H. nitidus Lambe, it can be distinguished by the rectangular microcorallites with arched tabulae. From H. süsmilchi Etheridge, H. infundibuliformis can only be distinguished by the arched microcorallite tabulae.

Associated fauna:

U. of A. No. 1142: Syringopora verticulata Goldfuss, Synatophyllum sp. and Favosites niagarensis Hall.

U. of A. No. 38537: Neozaphrentis(?) sp., Clathrodictyon sp., Favosites niagarensis Hall, F. sp., cf. F. gothlandicus Lamarck.

U. of A. No. 153: Neozaphrentis sp. and Favosites gothlandicus Lamarck.

U. of A. No. 37299: Favosites niagarensis Hall

No. 1141: Pentamerus sp. and Favosites sp., cf. F. gothlandicus Lamarck.

U. of A. 37633: Clathrodictyon sp.

U. of A. No. 37047: Synatophyllum sp., cf. S. arundinaceum (Billings), Neozaphrentis sp., Favosites niagarensis inequalis Stearn and F. sp., cf. F. gothlandicus Lamarck.

U. of A. No. 1137: Palaeophyllum sp., Favosites niagarensis Hall, and F. niagarensis inequalis Stearn

HALYSITES [CYSTIHALYSITES] LATUS Tchernychev, 1937

Pl. 3 Figs. 7-10, Text fig. 2B

Halysites catenularius var. lata TCHERNYCHEV, 1937, Trans. Arctic Instit. Leningrad, v. 91, p. 99-100, pl. 10, figs. 3a, 3b; pl. 12, fig. 3, text fig. 3.

Halysites lata Tchernychev. BUEHLER, 1955, Peabody Mus. Nat. History, Bull. 8, p. 62.

Description of Figured Specimen U. of A. No. 39194a:

The corallum is gently sub-pyriform, incomplete, large, with

the surface measuring 9 cm. by 12 cm. The base is broken away and only the upper 3.5 cm. of vertical growth is present.

Transverse section: The chains anastomose in a sub-regular pattern, and are typically composed of 4 to 6 corallites with an observed range in numbers of 1 to 10. Corallite outlines are moderately undulate. Lacunae are irregular, sub-oval, sub-rectangular or gently labyrinthine, 2 to 11 mm. in width by 9 to 38 mm. in length, with an average of 6 mm. by 20 mm. Autocorallites are oval, very large, 1.9 to 2.7 mm. in width and 2.7 to 3.2 mm. in length, with an average of 2.2 mm. by 2.9 mm. Microcorallites are rectangular, transversely elongate, large, measuring 1.1 mm. by 0.6 mm. No septa were observed.

Longitudinal section: Corallite walls have strongly developed growth lines approximately 1 mm. apart. Autocorallite tabulae are thin, complete, flat, and 0.4 to 0.6 mm. apart. Microcorallite tabulae are complete or vesicular, convex upwards, and about 0.2 mm. distant.

Material and Location:

Figured specimen U. of A. No. 39194a. Ronning group (Silurian), no stratigraphic position available. Northeastern British Columbia.

Four other specimens from the Ronning group. Three (U. of A. Nos. 39194b, 1130, 1126) from British Columbia, one questionably from the lower and one from the middle part of the Silurian beds, one unlocated. One (U. of A. No. 37308) from the Northwest Territories, questionably from the upper part of Silurian beds.

Remarks: The figured specimen differs only from the holotype in the slightly larger microcorallites. Although microcorallite tabulae of the holotype are described as "concave", Tcherneychev's figure distinctly shows them as convex upwards (1937, pl. 10, fig. 3b).

Halysites latus is distinguished by its large autocorallites and commonly sub-oval lacunae. It differs from H. magnitubus Buehler only by having transversely elongate microcorallites. The two species are closely related and if microcorallite shapes are found to vary within individual colonies, H. magnitubus would likely become synonymous with H. latus. Halysites latus has considerably smaller autocorallites than H. magnitubus forma 1 and lacunae which are closed in contrast to those of H. nexus Davis.

Associated fauna:

Figured specimen U. of A. No. 39194a: H. mirabilis
Tchernychev.

U. of A. No. 1130: H. brownsportensis Amsden.

HALYSITES [CYSTIHALYSITES] MAGNITUBUS Buehler forma 1

Pl. 4 Figs. 1-5, Text fig. 2A

Halysites magnitubus BUEHLER, [partim] 1955, Peabody Mus. Nat.
History, Bull. 8, p. 68.

Description of Figured Specimens U. of A. No. 1127 and U. of A. No. 1125:
(the latter for microcorallite tabulae alone).

The corallum is gently sub-pyriform, incomplete with the surface measuring 2.7 cm. by 6.0 cm. Only the upper 6.0 cm. of vertical growth is present.

Transverse section: The chains are fairly straight to gently meandering, anastomosing in a sub-regular pattern, and have 1 to 3 corallites per chain. Corallite outlines are strongly undulate. Lacunae are elongate, irregular or gently labyrinthine, 3 to 7 mm. in width by 7 to 16 mm. in length. Autocorallites are extremely large,

oval to nearly circular, 3.0 to 3.2 mm. in width and 3.7 to 4.0 mm. in length. Microcorallites are rectangular, parallelogrammic with deeply concave outlines, and typically measure 1 mm. by 2 mm., but at chain junctions commonly they are very narrow and more drawn out longitudinally.

Longitudinal section: Corallite walls have broad, gentle growth lines spaced at 1.2 to 2 mm. Autocorallite tabulae are thin, flat or concave upwards, and up to 1 mm. apart. Microcorallite tabulae are complete to partly vesicular, convex upwards, and 0.2 mm. to 0.5 mm. distant.

Material and Location:

Figured specimen No. 1127. Ronning group (Silurian), from talus 40' below the top. 5 miles north of Robb Lake, British Columbia, 56° 34' N., 123° 40' W.

Figured specimen U. of A. No. 1125. From talus at the junction of the Nabesche and Peace Rivers, British Columbia, 56° 05' N., 123° 05' W.

Remarks: A longitudinal section of U. of A. No. 1125 specimen is pictured as microcorallite tabulae are more clearly preserved than those in No. 1127.

Halysites magnitubus forma 1 differs from H. magnitubus Buehler by having considerably larger, more circular autocorallites. Halysites magnitubus was described as having microcorallite tabulae concave upwards (Buehler, 1955, p. 68), but the present writer suggests that the holotype was inverted during description. All other species with arched microcorallite tabulae have them convex upwards. Buehler (ibid) reported a specimen from California (U.S.N.M. 123429) which is

probably conspecific with this form as corallites are equal in size to the figured specimen. Until more specimens, establish either the gradational or distinct autocorallite dimensions of H. magnitubus forma 1, the writer proposes that the figured specimen be made a form of H. magnitubus.

Halysites magnitubus forma 1 is distinguished by the extremely large size of the autocorallites. From H. latus Tchernychev, it differs by having transversely elongate microcorallites and larger autocorallites.

Associated fauna: Nil.

HALYSITES [CYSTIHALYSITES] MIRABILIS Tchernychev, 1941

Pl. 4 Figs. 6-9, Text fig. 2C

Halysites mirabilis TCHERNYCHEV, 1941, Trans. Arctic Instit. Leningrad, v. 158, p. 70-72, pl. 2, figs. 5-7; pl. 3, figs. 1-6.

Description of Figured Specimen U. of A. No. 1191:

The corallum is tabular, incomplete, with surface measuring 4.5 by 7.5 cm. Only the distal 3.5 cm. of the colony is present.

Transverse section: The chains anastomose in a sub-parallel meandering pattern and have from 1 to 7 corallites. Corallite outlines are highly undulate. Lacunae are irregular or labyrinthine, measuring 1 to 7 mm. in width by 8 to over 22 mm. in length. Autocorallites are circular to slightly oval, 1.3 to 1.9 mm. in width by 1.7 to 2.2 mm. in length, with an average size of 1.8 mm. by 2.0 mm. Microcorallites are rectangular, transversely elongate and measure 0.8 mm. by 0.3 mm. No septa were observed.

Longitudinal section: Corallite walls possess well defined closely spaced growth lines at 0.7 mm. intervals. Autocorallite tabulae are thin, complete, flat, and generally 0.5 mm. apart. Microcorallite tabulae are complete or vesicular, strongly convex upwards and 0.2 mm. apart.

Material and Location:

Figured specimen U. of A. No. 1191. Ronning group (Silurian), no stratigraphic nor geographic position available. Likely collected along the Alaska Highway in northeastern British Columbia.

Three specimens (U. of A. Nos. 35183, 1133 and 1134) from the Ronning group of British Columbia, two from the lower and one from the upper part of the Silurian beds.

Remarks: The figured specimen differs only from the holotype in having slightly smaller, aseptate autocorallites. Halysites mirabilis is genus type to Cystihalysites, proposed by Tchernychev (1941, p. 70) to include Halysitidae with vesicular microcorallite tabulae. Apparently Tchernychev did not intend that they be entirely vesicular as illustrations of the genus type (ibid, pl. 3, figs. 1-6) show microcorallite tabulae to be both vesicular and complete.

Halysites mirabilis is distinguished by the circular or nearly circular autocorallites, arched, partly vesicular microcorallite tabulae and narrow, commonly labyrinthine lacunae. It differs from H. brown-sportensis Amsden only in having circular autocorallites.

Associated fauna:

Figured specimen U. of A. No. 1191: Halysites latus Tchernychev.

U. of A. No. 38185: Catenipora n. sp. 1

U. of A. No. 1133: Favosites sp.

U. of A. No. 1134: Favosites gothlandica Lamarck.

HALYSITES [CYSTIHALYSITES] NEXUS DAVIS, 1885

Pl. 5 Figs. 1-5, Text fig. 2E

Halysites nexus DAVIS, 1885, Kentucky Geol. Survey, pt. 2, pl. 67, figs. 4, 5; BUEHLER, 1955, Peabody Mus. Nat. History, Bull. 8, p. 45, pl. 7, figs. 4,5.

Description of Holotype:

Transverse section: The specimen consists of only two sub-parallel, gently meandering, unconnected chains with as many as 14 corallites. Lacunae are unclosed and up to 25 mm. in width. Autocorallites are oval, large, 1.8 to 2 mm. in width and 2.5 to 3 mm. in length. Microcorallites are either square and 0.5 mm. across, or parallelogrammic, measuring up to 0.6 mm. in width and 1 mm. in length. No septa were observed.

Longitudinal section: Only a few tabulae were observed, those of the autocorallites being flat, mainly complete and spaced 0.6 to 0.8 mm. apart, and those of the microcorallites convex upwards, complete(?) and closely spaced.

Six paratypes, each consisting of a single chain fragment, contain autocorallites which range in size from 1.4 to 2 mm. in width by 2 to 3 mm. in length.

Description of Figured Specimen No. 1129:

The corallum is tabular, incomplete, measuring 5.2 cm. by 5.5 cm. and with only 2.5 cm. of vertical growth present.

Transverse section: The chains are parallel, straight to gently meandering, with up to 21 corallites per chain. Corallite outlines are moderately undulate. Lacunae are elongate, generally

unclosed and 3 to 7 mm. in width, an average being 4 mm. Autocorallites are oval, 1.2 to 1.9 mm. in width by 1.7 to 2.5 mm. in length, with an average of 1.6 mm. by 2.0 mm. Microcorallites are rectangular, transversely elongate and measure 0.7 mm. by 0.5 mm. No septa were observed.

Longitudinal section: Corallite wall surfaces were not observed. Autocorallite tabulae are complete, flat, and typically 0.4 mm. apart. Microcorallite tabulae are strongly convex upwards, vesicular or complete and closely spaced.

Material and Location:

Holotype, Mus. Comp. Zoology, Cambridge, Massachusetts, No. 8785. Upper Niagara clay beds (Middle Silurian). Workhouse quarry and Fourth quarry on Beargrass Creek, East Louisville, Kentucky.

Paratypes, Mus. Comp. Zoology, Cambridge, Massachusetts, No. 8784. Presumably from same locality as the holotype(?).

Figured specimen No. 1129. Ronning group (Silurian), no stratigraphic location available. Southeast fork of South Nahanni and Flat Rivers, Northwest Territories, 61° 29' N., 125° 21' W.

One other specimen (No. 1128) from the Ronning group of British Columbia, no stratigraphic position available.

Remarks: The figured specimen differs only from the holotype in possessing smaller autocorallites and transversely elongate microcorallites.

Halysites nexus is distinguished by its parallel chains and unclosed lacunae. It differs from H. meandrina (Troost) in having parallel chains and slightly larger autocorallites.

Associated fauna:

No. 1128: Halysites brownsportensis Amsden, Catenipora n. sp. 1, and C. irregularis (Teichert).

HALYSITES sp., cf. H. CATENULARIUS (LINNAEUS) 1767

Pl. 5 Figs. 6-8, Text fig. 2I

cf. Tubipora catenularia LINNAEUS, 1767, Systema Naturae, Editio Duodecima Reformata, 12th ed., p. 1670.

cf. Halysites catenularius (Linnaeus). THOMAS and SMITH, 1954, Annals and Mag. Nat. History, ser. 7, v. 12, no. 82, p. 766-768, pl. 20, figs. 1a-1c; BUEHLER, 1955, Yale Peabody Mus. Nat. Hist. Bull. 8, p. 28; STEARN, 1956, Geol. Survey of Canada, Mem. 281, p. 71.

Description of Figured Specimen No. 1189:

The corallum is tabular, incomplete, small, measuring 2.5 cm. by 4 cm. with only 1 cm. of vertical growth present.

Transverse section: The chains are straight to gently meandering, closely spaced and composed of 1 to 3 corallites, the outlines of which are highly undulate. Lacunae are sub-rectangular, gently labyrinthine or sub-oval, measuring 2 to 5 mm. in width by 4 to greater than 12 mm. in length. Autocorallites are oval, 1.4 mm. in width by 1.9 mm. in length. Microcorallites are square or parallelogrammic, 0.2 mm. by 0.2 to 0.3 mm. No septa were observed.

Longitudinal section: External surface of corallite walls is not visible. Autocorallite tabulae are flat, complete, 0.2 to 0.5 mm. apart. Microcorallite tabulae are only faintly visible, appearing to be flat, complete and closely spaced.

Material and Location:

Figured specimen No. 1189. Stratigraphic and geographic location unavailable. Likely from the Ronning group (Silurian) of northeastern British Columbia.

Remarks: The figured specimen is compared to H. catenularius rather than H. labyrinthicus (Goldfuss) on autocorallite size alone, the latter

species differing only from the former by having slightly larger autocorallites. Halysites labyrinthicus is most likely synonymous with H. catenularius as morphologic differences are hardly sufficient to be of distinct specific value.

The relationship of the figured specimen to H. catenularius is dubious, based on the similar non-septate autocorallites, and flat microcorallite tabulae. The major difference is that the lacunae of the figured specimen are not labyrinthine. The microcorallites are also smaller and the chains composed of fewer corallites.

It is unfortunate that stratigraphic or geographic locations are unavailable. Halysites sp., cf. H. catenularius differs from H. labyrinthicus in possessing slightly smaller autocorallites and non-labyrinthine lacunae. It is distinguished from H. nitidus Lambe in possessing larger corallites and straight, more widely spaced chains. Associated fauna: Nil.

HALYSITES sp., cf. H. SÜSSMILCHI Etheridge, 1904

Pl. 6 Figs. 1-4, Text fig. 2J

cf. Halysites süssmilchi ETHERIDGE, 1904, Mem. Geol. Survey New South Wales, Palaeontology No. 13, pt. 1, p. 26-27, pl. 3, figs. 3, 4; pl. 7, figs. 1-3.

Description of Figured Specimen U. of A. No. 37276:

The corallum is sub-pyriform, incomplete, small, measuring 3.5 cm. by 5.2 cm., with only the upper 3 cm. of vertical growth present.

Transverse Section: The chains are sub-parallel, meandering, and typically with 3 to 4 corallites, the outlines of which are highly undulate. Lacunae are labyrinthine, sub-oval or rectangular, 1.5 to

4 mm. in width by 4 to 12 mm. in length. Autocorallites are oval, small, from 0.6 to 1 mm. in width by 0.8 to 1.3 mm. in length, an average size being 0.8 mm. by 1 mm. Microcorallites are square, 0.2 to 0.3 mm. across, but at the chain junctions are commonly rectangular or "Y"-shaped. No septa were observed.

Longitudinal section: The corallite walls have fine, very closely spaced growth lines. Tabulae of the autocorallites are flat, complete and regularly 0.2 to 0.3 mm. apart, while those of the microcorallites are flat, complete and spaced at less than 0.1 mm. intervals.

Material and Location:

Figured specimen, U. of A. No. 37276. Ronning group (Silurian), no stratigraphic position available. 40 miles north of Finlay Forks, British Columbia, 56° 38' N., 123° 35' W.

Four specimens (U. of A. Nos. 1135, 1136, 1137, 1139) from the Ronning group of British Columbia, all from the lower part of the Silurian beds. One tentatively identified specimen (U. of A. No. Si243) from the Middle Silurian Lockport formation at Lake Timiskaming, Ontario.

Remarks: Halysites süssmilchi closely resembles H. nitidus Lambe, differing only being aseptate. It is on this characteristic alone that the figured specimen, a well preserved corallum, is compared with H. süssmilchi and not H. nitidus.

The figured specimen has slightly smaller autocorallites and less labyrinthine fenestrules than H. süssmilchi. This species is distinguished by the flat microcorallite tabulae, very small autocorallites and labyrinthine lacunae. Catenipora microporus (Whitfield) is a monomorphic twin. The strongly undulate corallite outlines distinguish Halysites sp., cf. H. süssmilchi from H. tenuis Hamada and

H. [Schedohalysites] kitakamiensis (Sugiyama).

Associated fauna:

U. of A. No. 37276: Chonophyllum sp., cf. C. magnificum
Billings, Heliolites(?) sp., cf. H. elegans Hall,
and Favosites sp., cf. F. gothlandicus Lamarck.

U. of A. No. 1139: Pentamerus sp.

Subfamily CATENIPORINAE

Genus CATENIPORA Lamarck, 1816

CATENIPORA GOTLANDICA (YABE) 1915

Pl. 6 Figs. 5-7, Text fig. 3A

Halysites gotlandicus YABE, 1915, Tokyo Imp. Univ. Sci. Repts.,
Geology, v. 4, p. 34, pl. 7, figs. 1, 2; TCHERNYCHEV,
1937, Trans. Arctic Instit. Leningrad, v. 91, p. 94,
95, pl. 11, figs. 1, 2; BUEHLER, 1955, Peabody Mus.
Nat. Hist., Bull. 8, p. 57.

Catenipora gotlandicus (Yabe). HAMADA, 1957, Jour. Faculty Sci.,
Tokyo Univ., sec. 2, v. 10, pt. 3, p. 400.

Description of Figured Specimen No. 1153:

The corallum is gently sub-pyriform, incomplete, with the
surface measuring 3 cm. by 4.5 cm. and with 4 cm. of vertical growth
present.

Transverse section: The chains are parallel, straight to very
gently meandering and typically composed of 1 to 3 corallites, although
up to 7 were observed. Corallite outlines are highly undulate. Lacunae
are elongate, rectangular, measuring 2 to 3 mm. in width and 5 mm. to
21 mm. in length. Autocorallites are oval to circular, very large,
2 to 2.3 mm. in width by 2 to 3 mm. in length. The wall is thin,
averaging 0.15 mm. in thickness. No septa were observed.

Longitudinal section: Corallite wall surfaces were not visible. Tabulae are mainly complete, gently concave upwards, and variably spaced, ranging from 0.2 to 1 mm.

Material and Location:

Figured specimen No. 1153. Ronning group (Silurian), 268' above the sandstone. Mount Peterson, British Columbia, 58° 51' N., 125° 47' W.

Three specimens from the Ronning group. One (U. of A. No. 1153) from British Columbia, no stratigraphic position available. Two (U. of A. Nos. 1151, 37504) tentatively identified from the Northwest Territories, located in basal Silurian beds.

Remarks: The figured specimen differs from the holotype in having thinner walls and slightly larger aseptate autocorallites. The holotype obviously does not have prominent septa as none could be observed in Yabe's figure (1915, pl. 7, fig. 1). The chains of Catenipora gotlandica were described as being similar to those of Halysites labyrinthicus (Goldfuss), implying a meandriiform habit, but the illustration of the holotype (ibid) show them to be fairly straight.

Tchernychev (1937, p. 94) described a hypotype of this species from Arctic Russia which is identical to the figured specimen except in being septate.

Buehler (1955, p. 57) is of the opinion that Yabe's illustration shows microcorallites present in the holotype. This illusion was probably created by the transverse section, through the holotype, intersecting parts of the tabulae.

Catenipora gotlandica is distinctive with its large, nearly circular autocorallites and straight, closely spaced chains.

Associated fauna:

U. of A. No. 37504: Favosites gothlandicus Lamarck.

U. of A. No. 1152: Synaptophyllum sp. and Favosites sp.,
cf. F. gothlandicus Lamarck.

CATENIPORA [QUEPORA?] IRREGULARIS (Teichert), 1937

Pl. 7 Figs. 1-4, Text fig. 3F

Halysites irregularis TEICHERT, 1937, Rept. 5th Thule Exped., 1921-24,
v. 1, no. 5, p. 132-133, pl. 7, figs. 4, 5; pl. 8, fig. 3.

Catenipora irregularis (Teichert). BUEHLER, 1955, Peabody Mus. Nat.
History, Bull. 8, p. 64.

Description of Figured Specimen No. 1128:

The corallum is hemispherical, incomplete, measuring 5.2 by 7.5 cm. with 5 cm. of vertical growth present. Overall appearance of the corallum is similar to a cerioid colony.

Transverse section: In parts of the colony, corallites are arranged in short, closely spaced chains of not more than 3 corallites. In others, however, each corallite is adjoined to four adjacent ones so that ranks are absent. Lacunae are as large as 1.5 mm. in width and 4 mm. in length but in general are less than 1 mm. in diameter. Auto-corallites are oval to circular but where joined to four adjacent ones are commonly angular. Their size varies from 1 mm. to 1.5 mm. in diameter. The walls are thin, averaging 0.1 mm. in width. No septa were observed.

Longitudinal section: Corallite walls are marked by indistinct fairly widely spaced growth lines. Tabulae are complete,

flat to gently concave upwards and spaced 0.2 to 0.4 mm. apart.

Material and Location:

Figured specimen No. 1128. Ronning group (Silurian), no stratigraphic position available. Mountain front of Tuchodi Lakes, British Columbia, 58° 16' N., 124° 18' W.

One specimen (No. 1140) from the Ronning group of British Columbia, located in the lower part of the Silurian beds.

Remarks: The figured specimen differs from the holotype in possessing more densely packed, aseptate corallites and more closely spaced tabulae. Septa may have been destroyed by recrystallization. Teichert does not mention the habit of corallites being joined to four adjacent ones but his figure (1937, pl. 7, fig. 4) shows this.

This species may be related to Labyrinthites, which Hill and Stumm (1956, p. F469) classify under the Halysitidae. It differs, however, in having corallites which are only partly polygonal, the remainder being oval, typical of the genus Catenipora.

Catenipora irregularis is distinguished by its densely packed corallites which often are connected to four adjacent corallites rather than the usual two. It differs from Halysites compactus Rominger in being monomorphic and from Labyrinthites childensis Lambe by its closely spaced, considerably smaller and commonly circular autocorallites.

Associated fauna:

Figured specimen No. 1128: Halysites brownsportensis Amsden, H. nexus Davis, and Catenipora n. sp. 1.

No. 1140: Halysites infundibuliformis Buehler

CATENIPORA [QUEPORA] n. sp. 1

Pl. 7 Figs. 5-8, Text fig. 3C.

Description of Figured Specimen U. of A. No. 1150:

The corallum is hemispherical, nearly complete, the surface measuring 5 cm. by 7 cm. and corallites are up to 4 cm. long.

Transverse section: The chains are sub-parallel, straight to gently meandering with 2 to 3 corallites per chain. Corallite outlines are moderately undulate. Lacunae are narrow, rectangular, triangular or irregular, 2 to 3 mm. in width by 5 to 13 mm. in length. Autocorallites are oval with rounded, slightly flattened ends, 1 to 1.2 mm. in width with the length ranging from 1.4 to 2 mm., an average being 1.8 mm. The wall is thick, 0.2 to 0.3 mm. in width. No septa were observed.

Longitudinal section: The corallite walls are marked by growth lines of varying intensity and spacing throughout the colony. Tabulae are flat, complete and quite regularly spaced 0.3 mm. apart.

Material and Location:

Figured specimen, U. of A. No. 1150. Ronning group (Silurian), 400' below the top and 120' above the sandstone. 20 miles north of Tuchodi Lakes, British Columbia, 58° 29' N., 124° 31' W.

Two specimens (U. of A. Nos. 1128, 35183) from the Ronning group of British Columbia, one from the lower part of the Silurian beds, one unlocated.

Remarks: Catenipora n. sp 1 is distinguished by its straight, closely spaced chains and moderately undulate corallite outlines. It differs from C. sindoensis (Shimizu, Ozaki, and Obata) by the elongate commonly rectangular lacunae. Unfortunately the writer was

unable to observe illustrations of C. sindoensis. Lack of septa and larger autocorallites distinguish C. n. sp. 1 from C. escharoides Lamarck. The corallite outlines are more undulate and lacunae are shorter than in C. taimyrica Tchernychev; autocorallites are considerably smaller, the walls thicker, and the chains straighter than C. simplex Lambe.

Catenipora n. sp. 1 superficially is easily mistaken for a dimorphic halysitid and only by an examination of polished or thin section can it be established as monomorphic.

Associated fauna:

Figured specimen U. of A. No. 1150: Favosites gothlandicus Lamarck and F. sp., cf. F. gothlandicus Lamarck

No. 1128: Halysites nexus Davis, H. brownsportensis Amsden and Catenipora irregularis (Teichert)

U. of A. No. 35185: Halysites mirabilis Tchernychev.

CATENIPORA [QUEPORA] n. sp. 1 forma 1

Pl. 8 Figs. 1-4, Text fig. 3D

Description of Figured Specimen U. of A. No. 1161:

The corallum is gently sub-pyriform incomplete, with the surface measuring 5 cm. by 5.5 cm. The base is broken away and only the upper 3.5 cm. of the colony is present.

Transverse section: The chains anastomose in a regular gently meandering to straight manner, and have 2 to 3 corallites. Lacunae are polygonal, rectangular or sub-triangular, 2 to 8 mm. in width by 5 to 17 mm. in length, with an average size of 5 mm. by 8 mm. Autocorallites are oval with almost pointed ends, and are regularly 1 mm. in width by

1.8 to 2 mm. in length. The wall averages 0.2 mm. in thickness. No septa were observed.

Longitudinal section: The corallite walls possess variable spaced, moderately indistinct growth lines. Tabulae are flat to very gently concave upwards, mainly complete and spaced 0.4 mm. apart.

Material and Location:

Figured specimen U. of A. No. 1161. Ronning group (Silurian), 810' below the top of the Silurian-Devonian contact(?). A fault is present at the base of section. Muncho Lake, British Columbia, 59° 02' N., 125° 43' W.

Four other specimens from the Ronning group (Nos. 1164, 1162, 1167, 1163?). Two from British Columbia, one in the lower part of the Silurian beds, one tentatively identified and unlocated. Two specimens from the Northwest Territories, both from the lower part of the Silurian beds.

Remarks: Catenipora n. sp. 1 forma 1 differs from C. n. sp. 1 in having wider, typically polygonal or nearly square lacunae and autocorallites which have narrower ends. More extensive collections are necessary to establish whether these distinguishing characters prove to be gradational or not. For the present time the writer proposes that they be made a form of C. n. sp. 1.

Catenipora n. sp. 1 forma 1 is distinguished by its undulate corallite outline, polygonal or square lacunae and moderately large autocorallites. It closely resembles C. sindoensis (Shimizo, Ozaki, and Obata) but differs in having flat to gently concave upwards tabulae and lacunae which are enclosed by generally greater than 10 corallites. The aseptate autocorallites of C. n. sp. 1 forma 1 are larger, and the corallite outlines more undulate than both C. escharoides Lamarck and C. elegans (Fischer-Benzoni).

Associated fauna:

Figured specimen U. of A. No. 1161: Catenipora irregularis Teichert, Favosites sp., cf. F. gothlandicus Lamarck, unidentifiable stromotoporoid.

CATENIPORA sp., cf. C. [QUEPORA] PULCHELLA (WILSON) 1926

Pl. 9 Figs. 1-4, Text fig. 3G

cf. Halysites pulchellus WILSON, 1926, Contr. Canadian Palaeontology, Geol. Survey Bull. 44, p. 15, pl. 3, figs. 8,9.

cf. Catenipora pulchellus (Wilson). BUEHLER, 1955, Yale Peabody Mus. Nat. History, Bull. 8, p. 59.

Description of Figured Specimen No. 1157:

The corallum is small, incomplete, measuring 3 cm. by 3.5 cm. with only 0.5 cm. of vertical growth present.

Transverse section: The chains anastomose in an irregular, sub-parallel, meandering pattern, and are composed of 2 to 5 corallites, the outlines of which are moderately undulate. Lacunae are labyrinthine or irregular, typically 3 to 4 mm. in width by 10 mm. in length. Auto-corallites are oval with rounded ends, and vary in size, a typical one measuring 0.6 mm. in width by 1 mm. in length. The wall is variable in thickness, ranging from 0.1 to 0.25 mm. in width. No septa were observed.

Longitudinal section: External wall surface is not visible.

Tabulae are flat, complete and are typically 0.2 mm. apart.

Material and Location:

Figured specimen No. 1157. Ronning group (Silurian), 1585' below the top and 450' above Upper Ordovician-Silurian contact. Guilbault Creek, British Columbia, 56° 34' N., 123° 36' W.

Four other specimens (Nos. 1159, 1160, 1156, U. of A. No. 1170) from the Ronning group of British Columbia, all from the lower part of the Silurian beds.

Remarks: The figured specimen is closely related to C. pulchella, differing only in possessing more closely spaced tabulae and possibly longer, more labyrinthine lacunae. It is unfortunate that the holotype is so small as only four complete lacunae are present, hardly enough to establish their pattern or size. The holotype of C. pulchella was reported from the Upper Ordovician Beaverfoot formation. If the present specimens are conspecific, then C. pulchella is apparently the only species transgressing the Ordovician-Silurian boundary.

Catenipora sp. cf. C. pulchella is distinguished by its small, oval autocorallites, narrow, labyrinthine lacunae and undulate corallite outlines. It resembles C. sp. B. but the chains are meandering.

Associated fauna: Nil.

CATENIPORA sp., cf. C. [QUEPORA] SIMPLEX (LAMBE), 1899

Pl. 8 Figs. 5-7, Text fig. 3B

cf. Halysites catenularia var. simplex LAMBE, 1899, Contr. Canadian Palaeontology, v. 4, pt. 1, p. 70, 76, pl. 4, figs. 3, 3a.

cf. Halysites aff. simplex Lambe. TCHERNYCHEV, 1937, Trans. Arctic Instit. Leningrad, v. 91, p. 121, p. 11, fig. 3.

cf. Catenipora simplex (Lambe). BUEHLER, 1955, Yale Peabody Mus. Nat. History, Bull, 8, p. 47-58, pl. 7, fig. 6; pl. 8, fig. 1.

Description of Figured Specimen No. 1166:

The specimen consists of an incomplete, gently sub-pyriform corallum, measuring 5.5 cm. by 7.5 cm. with corallites up to 7 cm. tall.

Transverse Section: The chains are sub-parallel, meandering and have 1 to 8 corallites, 5 being an average. Corallite outlines are moderately undulate. Lacunae are generally labyrinthine, 1.5 to 5.0 mm.

in width by 6.0 to 20.0 mm. in length. Autocorallites are oval, square-ended, 1.2 mm. in width by 1.7 mm. in length. The wall is thin, 0.1 to 0.2 mm. in width. No septa were observed.

Longitudinal section: Corallite walls are marked by fine, closely spaced growth lines at approximately 0.3 to 0.4 mm. intervals. Tabulae are mainly concave upwards, complete, 0.2 mm. apart.

Material and Location:

Figured specimen No. 1166. Ronning group (Silurian), 1195' below the top and 514' above the Ordovician-Silurian contact. About 15 miles northeast of Finlay Forks on the Peace River, British Columbia, 56° 05' N., 123° 31' W.

Three specimens (Nos. 1166, 1135, U. of A. No. 35507) from the Ronning group of British Columbia, two from the lower and one from the middle part of the Silurian beds.

Remarks: The figured specimen differs from C. simplex by having smaller autocorallites, more closely spaced tabulae, and narrower, more labyrinthine lacunae. The figured specimen is smaller than C. simplex in overall dimensions.

Catenipora sp., cf. C. simplex is distinguished by the labyrinthine lacunae, oval, square-ended autocorallites and undulate corallite outline. It differs from C. taimyrica (Tchernychev) in the above characteristics.

Associated fauna:

Figured specimen U. of A. No. 35507: Synaptophyllum sp., cf. S. arundinaceum (Billings).

CATENIPORA [QUEPORA] sp. A

Pl. 9 Figs. 5-7, Text fig. 3E

Description of Figured Specimen U. of A. No. 35183:

The corallum is sub-pyriform, incomplete, large, measuring 7.5 cm. by 8 cm. with corallites up to 9.5 cm. tall.

Transverse section: The chains are closely spaced in straight to gently meandering unidirectional rows which are generally interconnected at widely spaced intervals. Corallite outlines are moderately undulate. Lacunae are mainly narrowly rectangular, but in parts of the colony, they are labyrinthine or irregular, 2 to 3 mm. in width and varying considerably in length, 8 mm. being the shortest. One unclosed lacuna extends the entire length of the specimen (60 mm.). Autocorallites are oval, with rounded or pointed ends, typically 0.9 mm. in width by 1.7 mm. in length. A few are almost circular while others appear to be degenerate as they are very small. The wall is thick, 0.2 to 0.3 mm. in width. No septa were observed.

Longitudinal section: Corallite walls are marked by fine, fairly indistinct growth lines at approximately 0.4 mm. intervals. Tabulae are flat, complete, 0.2 to 0.4 mm. apart.

Material and Location:

Figured specimen U. of A. No. 35183. Ronning group (Silurian), approximately 2200' below the top. 10 miles north of Finlay Forks, British Columbia, 56° 08' N., 123° 28' W.

Remarks: Although the figured specimen occurs low in the Silurian Ronning with not footage from the base available, it is known that the specimen was collected a few hundred feet above the sandstones (see p. 21) and is

therefore considered to be Silurian in age.

Only the single specimen is present. Possibly it is an aberrant form.

Catenipora sp. A. is distinctive. Superficially it resembles the dimorphic Halysites nexus Davis, but the autocorallites are smaller. Catenipora taimyrica (Tchernychev) is the only cateniporid bearing any resemblance to C. sp. A. The latter differs by having moderately undulate corallite outlines.

Associated fauna:

Figured specimen, U. of A. No. 35183: Neozaphrentis sp., Coenites(?) sp., Corrugopora(?) rhabdota Stearn, Cystiphyllum sp., Favosites gothlandicus Lamarck, and F. niagarensis Hall.

CATENIPORA [QUEPORA?] sp. B

Pl. 9 Fig. 8, Text fig. 3H

Description of Figured Specimen U. of A. No. 1158:

The corallum is poorly preserved, sub-pyriform and is 3 cm. square with 2 cm. of vertical growth present.

Transverse section: The chains are straight, arranged in a grid-like pattern of almost mathematical regularity. Corallite outlines are highly undulate. Lacunae are rectangular, 1 mm. in width by 4 mm. in length. Autocorallites are oval, 0.7 mm. in width by 1.2 mm. in length. The walls are thin, 0.1 mm. in width. No septa were observed.

Longitudinal section: External surface of the corallite walls was not visible. Tabulae are absent by recrystallization.

Material and Location:

Figured specimen U. of A. No. 1158. Ronning group (Silurian?), no stratigraphic or geographic location available. Likely collected from northeastern British Columbia.

Remarks: There is no stratigraphic evidence to indicate either an Ordovician or a Silurian age. Only because of this species' resemblance to Silurian-like cateniporids with oval corallites and undulate walls, is it included here.

Catenipora sp. B is distinguished by the grid-like pattern its lacunae and the small oval autocorallites. It resembles C. pulchella Wilson but the lacunae are better patterned.

Associated fauna:

Figured specimen U. of A. No. 1158. Neozaphrentis manitobensis Stearn, N. sp., Favosites niagarensis Hall, F. sp., cf. F. gothlandicus Lamarck.

CATENIPORA [QUEPORA] sp. C

Pl. 9 Figs. 9-11, Text fig. 3I

Description of Figured Specimen U. of A. No. 615:

The corallum is gently sub-pyriform, measuring 1.5 cm. by 4.0 cm. with corallites up to 2.0 cm. tall.

Transverse section: The chains are densely packed, commonly abutting, and composed of no more than 4 corallites, the outlines of which are highly undulate. Lacunae are narrow, maximum size being 3 mm. by 7 mm. Autocorallites are generally oval with rounded or pointed ends, measuring 0.8 to 1.0 mm. in width by 1.2 to 1.6 mm. in length, or occasionally circular, averaging 1.1 mm. in diameter. Wall thickness on corallite sides is 0.2 mm. but between corallites it

varies considerably, ranging from 0.2 to 0.6 mm. or greater. No septa were observed.

Longitudinal section: The corallite walls have distinct growth lines spaced at 0.7 mm. intervals. Tabulae are flat, mainly complete and typically 0.4 mm. apart.

Material and Location:

Figured specimen U. of A. No. 615. Ronning group (Silurian?), no stratigraphic location available. Robb Lake, British Columbia, 56° 59' N., 123° 40' W.

One specimen (No. 1127) from talus 40' below the top of the Ronning group in the Robb Lake area of British Columbia.

Remarks: Catenipora sp. C is considered only tentatively of Silurian age, based on the talus position within the Silurian Ronning of No. 1127 and the occurrence of Halysites mirabilis also in talus.

Catenipora sp. C closely resembles C. elegans (Fischer-Benzoni) with similarly sized autocorallites and closely packed chains, but differs in lacking a pseudocolumella. The dimorphic Halysites agglomeratus Hall closely resembles Catenipora sp. C. Catenipora sp. C differs from C. irregularis (Teichert) by the halysitoid corallite arrangement and the rounded autocorallites.

Associated fauna:

No. 1127: Halysites mirabilis Tchernychev (also in talus).

Explanation of Plate 1

Figs. 1-6. Halysites [Cystihalysites] agglomeratus Hall p. 25

1. Transverse view of Lectotype, Am. Mus. Nat. History No. 1690 2:1. (X1).
2. Longitudinal view of "Lectoparatype", Am. Mus. Nat. History No. 1690 2:2. (X1).
3. Transverse view of Figured specimen U. of A. No. 1132. (X1).
4. Transverse view of U. of A. No. 1190; showing intergrowth of Halysites with Clathrodictyon sp. (X1).
- 5,6. Longitudinal and transverse thin sections of Figured specimen U. of A. No. 1132; showing vesicular microcorallite tabulae and septal spinules. (approx. X5)

PLATE 1.



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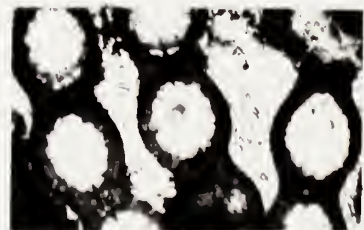
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Explanation of Plate 2

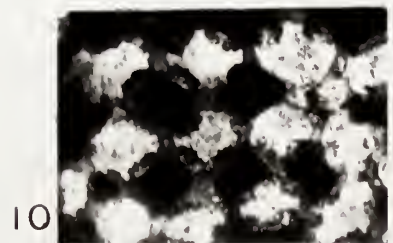
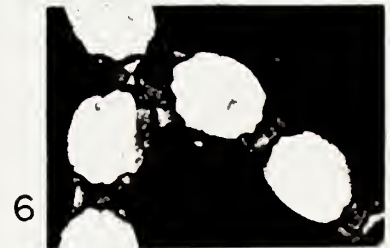
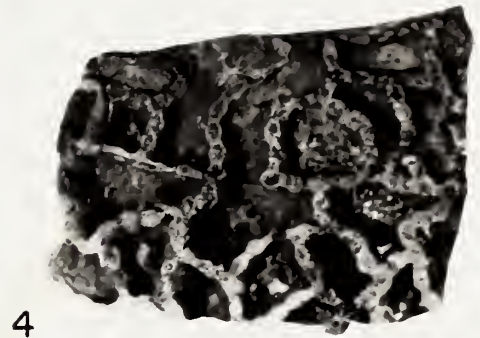
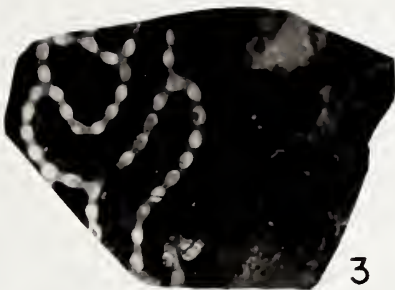
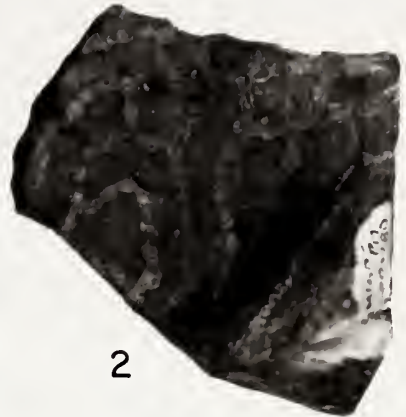
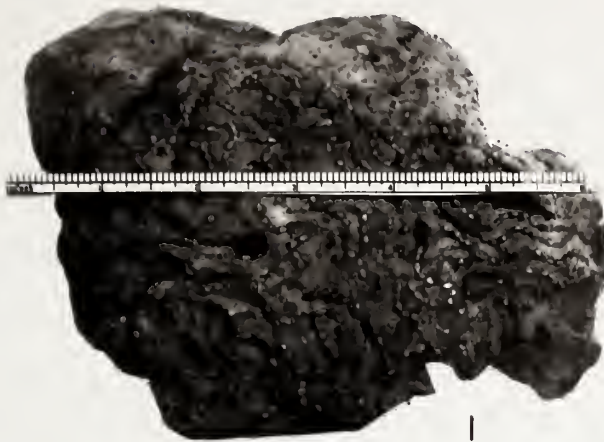
Figs. 1-6. Halysites [Cystihalysites] brownspontensis Amsden ... p. 28

1. Transverse view of Holotype, Yale Peabody Mus. No. 17638. (X1/2).
- 2,3. Transverse view and thin section of Figured specimen, U. of A. No. 1130. (X1).
4. Transverse view of U. of A. No. 1128; showing less labyrinthine lacunae. (X1).
- 5,6. Longitudinal and transverse thin sections of Figured specimen, U. of A. No. 1130: note partly vesicular microcorallite tabulae. (approx. X5).

Figs. 7-10. Halysites [Densoporites] compactus Rominger p. 31

- 7,8. Transverse view and thin section of Figured specimen, No. 1144. (X1).
- 9,10. Longitudinal and transverse thin sections of Figured specimen, No. 1144. (approx. X5).

PLATE 2.



Explanation of Plate 3

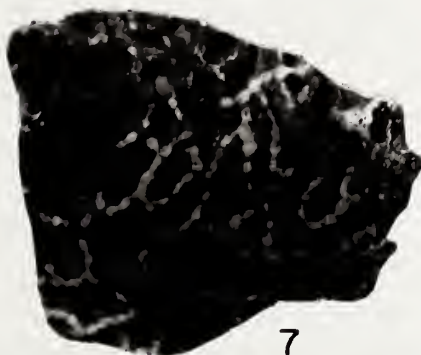
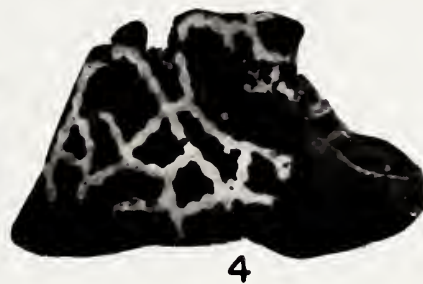
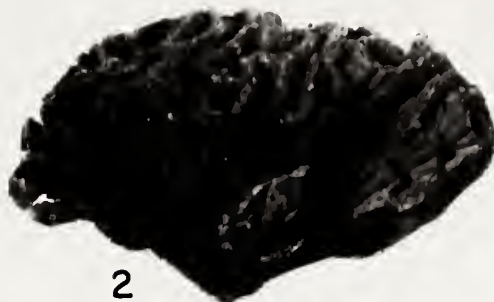
Figs. 1-6. Halysites infundibuliformis Buehler p. 33

- 1,2. Transverse and longitudinal views of Holotype, Yale Peabody Mus. No. 19142. (X1).
3. Oblique view of Figured specimen, U. of A. No. 37507. (X1).
4. Transverse polished section of Figured specimen, U. of A. No. 37507. (X1).
- 5,6. Longitudinal and transverse thin sections of Figured specimen U. of A. No. 37507; note intersitial increase in fig. 5. (approx. X5).

Figs. 7-10. Halysites [Cystihalysites] latus Tchernychev p. 36

7. Transverse view of Figured specimen, U. of A. No. 39194a. (X1/2).
8. Transverse thin section of Figured specimen, U. of A. No. 39194a. (X1).
- 9,10. Longitudinal and transverse thin sections of Figured specimen, U. of A. No. 39194a; microcorallite tabulae retouched, strong vesicular development not visible. (approx. X5).

PLATE 3.



Explanation of Plate 4

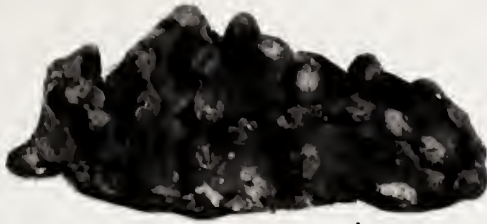
Figs. 1-5. Halysites [Cystihalysites] magnitubus Bushler forma 1 .. p. 38

- 1,2. Transverse and longitudinal views of Figured specimen, No. 1127. (X1).
3. Transverse thin section of Figured specimen, No. 1127. (X1).
4. Longitudinal thin section of Figured specimen U. of A. No. 1125; microcorallite tabulae retouched, strongly vesicular development not visible. (approx. X5).
5. Transverse thin section of Figured specimen, No. 1127. (approx. X5).

Figs. 6-9. Halysites [Cystihalysites] mirabilis Tchernychev ... p. 40

- 6,7. Transverse view and thin section of Figured specimen, U. of A. No. 1191. (X1).
- 8,9. Longitudinal and transverse thin sections of Figured specimen, U. of A. No. 1191; vesicular microcorallite tabulae barely visible in lower right of fig. 8. (approx. X5).

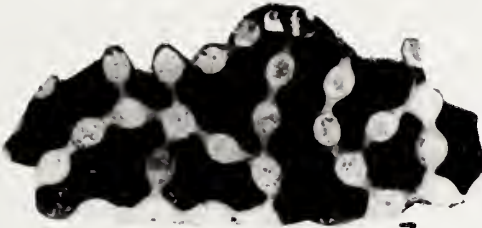
PLATE 4.



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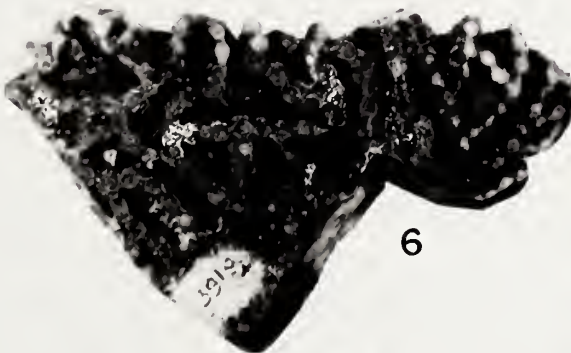
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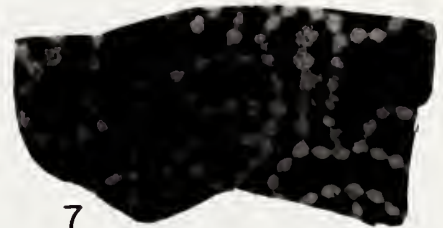
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Explanation of Plate 5

Figs. 1-5. Halysites [Cystihalysites] nexus Davis p. 42

1. Transverse view of Holotype, Mus. Comp. Zoology, Cambridge, Mass., No. 8785. (approx. X1).
2. Transverse polished section of Figured specimen, No. 1129. (X1).
3. Transverse thin section of Figured specimen, No. 1129. (slightly less than X1).
- 4,5. Transverse and longitudinal thin section of Figured specimen, No. 1129; note clusters of vesicular microcorallite tabulae. (approx. X5).

Figs. 6-8. Halysites sp., cf. H. catenularius (Linnaeus) p. 44

6. Transverse polished section of Figured specimen, No. 1189. (X1).
7. Diagrammatic longitudinal sketch of Figured specimen, No. 1189. (approx. X5).
8. Transverse thin section of Figured specimen, No. 1189. (approx. X5).

PLATE 5.



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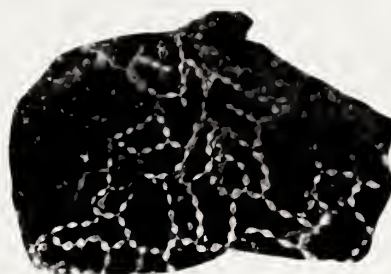
Explanation of Plate 6

- Figs. 1-4. Halysites sp., cf. H. süssmilchi Etheridge p. 45
- 1,2. Transverse view and thin section of Figured specimen,
U. of A. No. 37276. (X1).
- 3,4. Longitudinal and transverse thin sections of Figured
specimen U. of A. No. 37276; tabulae at right on figure
3 are microcorallite tabulae. (approx. X5).
- Figs. 5-7. Catenipora gotlandica (Yabe) p. 47
5. Transverse polished section of Figured specimen,
No. 1153. (X1).
6. Longitudinal sketch of Figured specimen, No. 1153.
(approx. X5).
7. Transverse thin section of Figured specimen No. 1153.
(approx. X5).

PLATE 6.



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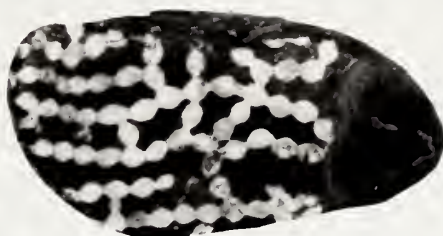
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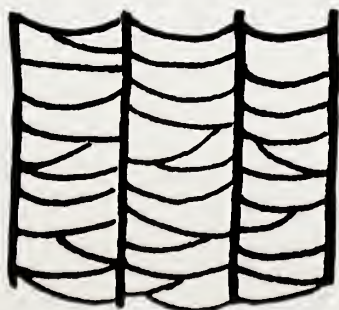
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Explanation of Plate 7

Figs. 1-4. Catenipora [Quepora?] irregularis (Teichert) p. 49

1,2. Transverse view and thin section of Figured specimen No. 1128. (X1).

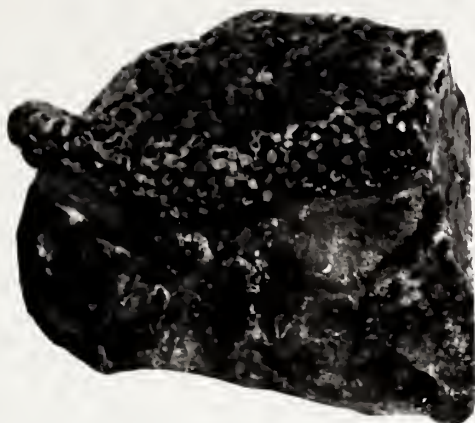
3,4. Longitudinal and transverse thin sections of Figured specimen, No. 1128. (approx. X5).

Figs. 5-8. Catenipora [Quepora] n. sp. I p. 51

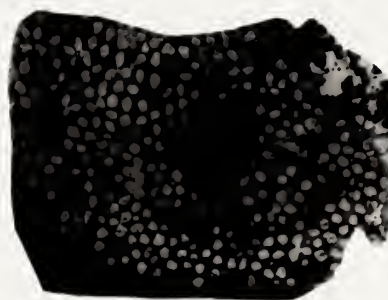
5,6. Transverse view and thin section of Figured specimen, U. of A. No. 1150. (X1).

7,8. Longitudinal and transverse thin sections of Figured specimen, U. of A. No. 1150; lacunae of fig. 8 are retouched with ink. (approx. X5).

PLATE 7.



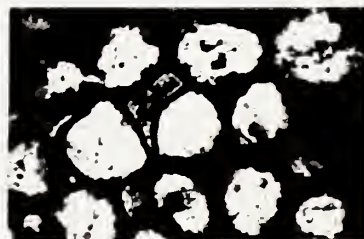
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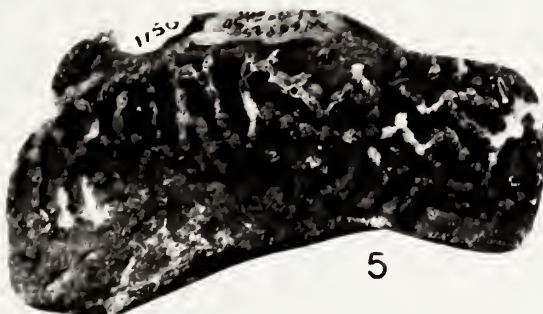
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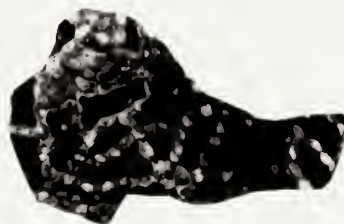
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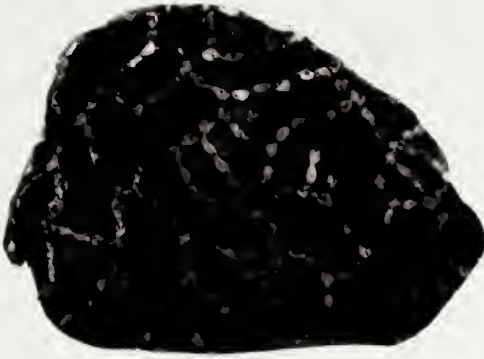


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Explanation of Plate 8

- Figs. 1-4. Catenipora [Quepora] n. sp. 1 forma 1 p. 52
- 1,2. Transverse view and thin section of Figured specimen,
U. of A. No. 1161. (X1).
- 3,4. Longitudinal and transverse thin sections of Figured
specimen, U. of A. No. 1161. (approx. X5).
- Figs. 5-7. Catenipora sp., cf. C. [Quepora] simplex (Lambe) p. 55
5. Transverse polished section of Figured specimen, No.
1166. (X1).
- 6,7. Longitudinal and transverse thin sections of Figured
specimen, No. 1166. (approx. X5).

PLATE 8.



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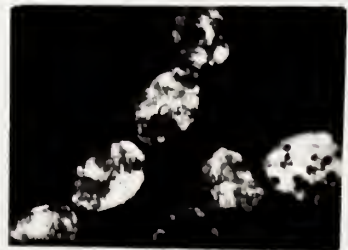
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Explanation of Plate 9

Figs. 1-4. Catenipora sp., cf. C. [Quepora] pulchella (Wilson) .. p. 54

1,2. Transverse polished and thin section of Figured specimen,
No. 1157. (X1).

3,4. Longitudinal and transverse thin sections of Figured
specimen, No. 1157. (approx. X5).

Figs. 5-7. Catenipora [Quepora] sp. A p. 57

5. Transverse polished section of Figured specimen,
U. of A. No. 35183. (X1).

6,7. Transverse and longitudinal thin sections of Figured
specimen, U. of A. No. 35183. (approx. X5).

Fig. 8. Catenipora [Quepora] sp. B p. 58
Transverse polished section of Figured specimen,
U. of A. No. 1158.

Figs. 9-11. Catenipora [Quepora] sp. C p. 59

9. Transverse view of Figured specimen U. of A. No. 615.

10,11. Longitudinal and transverse thin sections of Figured
specimen, U. of A. No. 615. (approx. X5).

PLATE 9.



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APPENDIX

Measurements and abbreviated descriptions of taxonomically important features of all specimens examined are included below. Specimen numbers preceeded by a question mark are tentatively identified.

Specimen numbers which contain "U. of A." are on repository in the Department of Geology at the University of Alberta, Edmonton. All others are on repository with the California Standard Company, Edmonton.

Abbreviations are as follows:

ang. -----	angular
approx. -----	approximately
av. -----	average
circ. -----	circular
conc. up. -----	concave upward
conv. up. -----	convex upward
irreg. -----	irregular
laby. -----	labyrinthine
occas. -----	occasionally
para. -----	parallelogrammic
polyg. -----	polygonal
pres. -----	present
rect. -----	rectangular
sq. -----	square
sub-rect. -----	sub-rectangular
sub-triang. -----	sub-triangular
trans. elong. ---	transversely elongate
var. -----	variable
/ -----	to

SPECIMEN NUMBER	LACUNAE		AUTOCORALLITES		MICROCORALLITES		SEPTA	AUTOCORALLITE TABULAE		MICROCORALLITE TABULAE	
	SHAPE	SIZE (mm)	SHAPE	SIZE (mm)	SHAPE	SIZE (mm)		SHAPE	SPACING (mm)	SHAPE	APPEARANCE
Halysites [<u>Cystihalysites</u>] <u>agglomeratus</u> Hall											
Lectotype Am.N.H.No. 1690, 2:1	very narrow		circ.	1-1.2 x 1.2-1.4	sq. or trans. elong.	0.5	none (?)	conc. up.	?	conv. up.	complete(?)
Fig. Spec. U. of A. No. 1132	very narrow		circ. or oval	1.4 or 1.3x1.9	sq.	0.5	yes (12)	flat/ conc. up.	0.2-0.4	conv. up.	mainly vesicular
U. of A. No. 1131	narrow or rect.	3.1 x 8	oval or circ.	1.5x2.0	sq. or trans. elong.	var.	yes (12)	flat/ conc. up.	0.2-0.5	conv. up.	mainly vesicular

Halysites [Cystihalysites] brownspontensis Amsden

Holotype Y.P.M. No. 17638	laby.	3 x up to 50	oval	1.5 x 2.	sq. or trans. elong.	0.4	occas. pres.	flat/ conc. up.	0.2	conv. up.	vesicular or complete
Fig. Spec. U. of A. No. 1130	laby.	3-10x13 -25	oval	1.6x2.1	trans. elong.	0.9x0.4	none	conc. up or flat	0.3	conv. up.	complete or vesicular
U. of A. No. S1236	laby.	4-10 x 20-30	oval	1.4x2.2	trans. elong.	1 x 0.6	none	flat	0.3	conv. up.	complete
U. of A. No. 1145	laby.		oval	1.5x2.5	trans. elong.	1 x 0.6	none	flat	0.3	conv. up.	mainly vesicular
U. of A.? No. 1148	corallum broken up		oval	1.7x2.5	trans. elong.	1.1x0.7	none	flat	0.4	conv. up.	complete or vesicular

SPECIMEN NUMBER	LACUNAE		AUTOCORALLITES		MICROCORALLITES		SEPTA	AUTOCORALLITE TABULAE		MICROCORALLITE TABULAE	
	SHAPE	SIZE (mm)	SHAPE	SIZE (mm)	SHAPE	SIZE (mm)		SHAPE	SPACING (mm)	SHAPE	APPEARANCE
U. of A. No. 37554	laby.	3-6 x ?	oval	1.8 x 2.	trans. elong. or sq.	1 x 0.7	none	flat	0.3-0.8	conv. up	complete or vesicular
U. of A. No. 1149	laby. or irreg.	2-7 + x?	oval	av. 1.8- 2x2, 2-2.5	trans. elong.	0.5x1.5 (var.)	none	flat	0.3-0.8	conv. up.	vesicular or complete
U. of A. No. 1143	laby.	5-10 x ?	oval	1.8x2.5	trans. elong.	0.8x1.1 (var.)	none	flat or conc. up.	.5-1.2	conv. up.	complete or occas. vesicular
U. of A. No. 1177	sub- rect.	4x8-10	oval	1.8x2.5- 2.8	sq. or trans. elong.	0.6-0.9x 0.4-0.7	none	conc. up. or flat	0.5-0.7	conv. up.	vesicular or complete
U. of A. No. 37477	sub- rect.	4-8x10+	oval	1.7x2.4	trans. elong.	0.4-0.7x 1.	none	conc. up.	0.4-0.7	conv. up.	complete or vesicular
U. of A. No. 37514	sub- rect. or laby.	4-7x7?	oval	1.5-1.8x 2.5	trans. elong.	0.5x0.9	none	flat or conc. up.	0.3-0.7	conv. up.	complete (and vesicular?)
U. of A. No. 1173	sub- rect. or laby.	3-10x 10-20	oval occas. circ.	1.7-1.9x 1.8-2.5	sq. or trans. elong.	0.7-0.9x 0.9-1.3	12 very small	flat or conc. up.	0.3-0.8	conv. up.	complete or vesicular
No. 1128	laby. or sub- rect.	5-10x 6-30 +	oval	2x2.5-3	trans. elong.	0.4-0.6x 1.4	none	flat or conc. up.	0.7-1.	conv. up.	complete or vesicular
No. 1188	laby. (?)	3-1 x ?	oval	1.4-1.9x 2.1-2.4	trans. elong.	1 x 0.7	none	flat	0.4-1	conv. up.	complete (vesicular?)
No. 1146	laby. or irreg.	1.5-7 x 13- ?	oval	1.2-1.8x 1.9-2.4	trans. elong.	0.5-1 x 0.5	none	flat	0.4-0.7	conv. up.	complete (vesicu- lar?)

(H. brownsportensis, cont'd)

SPECIMEN NUMBER	LACUNAE		AUTOCORALLITES		MICROCORALLITES		SEPTA	AUTOCORALLITE TABULAE		MICROCORALLITE TABULAE	
	SHAPE	SIZE (mm)	SHAPE	SIZE (mm)	SHAPE	SIZE (mm)		SHAPE	SPACING (mm)	SHAPE	APPEARANCE
No. 1147	laby. or absent	0-1 x ?	oval	1.5x2.5	trans. elong.	1 x 0.4	none	flat	0.7	conv. up.	complete or occas. vesicular
No. 1144	laby.	broken up 0.7-10x?	oval	1.5-2 x 2.5-3.2	trans. elong.	1.2-1.5x 0.7	none	flat	0.7-0.9	conv. up.	complete or occas. vesicular
No. 1175	sub- rect. or laby.	3-7x6-17	oval	1.7x2.5	trans. elong.	0.4-0.6x 0.9	none	flat	0.3-0.8	conv. up.	vesicular or complete
<u>Halysites</u> [<u>Densoporites</u>] <u>compactus</u> Rominger											
Fig. Spec. No. 1144	very small corallum nearly cerioid		oval, circ., ang.	1-1.5	trans. elong.	approx. 0.6x0.4	none	flat	0.2-0.4	conv. up.	complete
<u>Halysites</u> <u>infundibuliformis</u> Buehler											
Holotype Y.P.M. No. 19142	laby.	up to 7 x 30	oval	0.9x1.4	para. or sq.	0.2x0.2- 0.5	none	conc. up.	0.2-0.5	conv. up.	mainly complete
Fig. Spec. U. of A. No. 37507	var.	2-3.5x 8-15	oval	1.2x1.5- 1.7	trans. elong.	0.4x0.1	none	flat or conc. up.	0.3	conv. up.	mainly complete
No. 1140	sub-rect. occas. laby.	2 x 5-8	oval	1.6x1.9	para. or trans. elong.	0.5-0.9x 0.7-1	none	flat	0.3-0.5	conv. up.	mainly complete
? No. 1137	sub-rect. or irreg.	2-4 x ?	oval	1.2x1.8	trans. elong.	0.6x0.4	none	flat	0.5	conv. up.	complete occas. vesicular

SPECIMEN NUMBER	LACUNAE		AUTOCORALLITES		MICROCORALLITES		SEPTA	AUTOCORALLITE TABULAE		MICROCORALLITE TABULAE	
	SHAPE	SIZE (mm)	SHAPE	SIZE (mm)	SHAPE	SIZE (mm)		SHAPE	SPACING (mm)	SHAPE	APPEARANCE
? No. 1141	sub- rect.or laby.	1-3x5-9	oval	1.2-1.4x 1.8-2	sq.	0.4 or less	none	flat	0.1-0.3	conv. up.(?)	complete (?)
No. 1142	laby.or irreg.	3-6 x 6- ?	oval	1-1.5 x 1.6-2	sq. or trans. elong.	0.5-0.7x 0.5	none	flat	.03	conv. up.	complete occas. vesicular
U. of A. No. 37509	laby.	3-4x4-12	oval	1.1-1.6x 0.8-1.	sq. or trans. elong.	0.5x0.2- 0.5	none	flat	0.3	conv. up.	complete or vesicular
U. of A. No. 37519	laby.	1-10 x 12-33	oval	0.8-1.1x 1.5-2	trans. elong.	0.5x0.2	none	flat	0.5	conv. up.	complete or vesicular
U. of A. ? No. 37889	laby.	2.6x14- 22 +	oval	1x1.5- 1.8	var.	0.4x0.2- 0.5	none	flat	0.1-0.2	conv. up.	complete or vesicular
U. of A. No. 38537	sub- rect.	2-4 x 3- 19	oval	0.8-1.2x 1.6	sq.	0.1	none	flat	0.3	conv. up.	complete or vesicular
U. of A. ?No. 37201	irreg.	1-4 x 3- 10 +	oval	0.9x1.7	sq.	0.4	none	flat	0.1	conv. up.	complete(?)
U. of A. ?No. 42773	sub- rect.or laby.	2-6 x 4- 15	oval	1 x 1.5	mainly sq.	0.4	none	flat	0.2		obscured
U. of A. ?No. 37299	laby.	3 x 20 +	oval	1 x 1.5	trans. elong.	0.3x0.1	none	flat	0.3	conv. up.	complete(?)
U. of A. No. 37633	sub- rect.	3-7 x ?	oval	0.8-1.4x 1.5-1.8	trans. elong.	0.1x0.4- 0.7	none	flat	0.3	conv. up.	complete

SPECIMEN NUMBER	LACUNAE		AUTOCORALLITES		MICROCORALLITES		SEPTA	AUTOCORALLITE TABULAE		MICROCORALLITE TABULAE	
	SHAPE	SIZE (mm)	SHAPE	SIZE (mm)	SHAPE	SIZE (mm)		SHAPE	SPACING (mm)	SHAPE	APPEARANCE
U. of A. No. 37047	sub- rect.or laby.	3 - 6 x 5-14	oval	0.9-1.2- 1.6-2.3	sq. or trans. elong.	0.6x0.2- 0.6	none	flat	0.3-0.6	conv. up.	complete(?)
U. of A. Nos. 153-156 sub-rect.	laby.or sub-rect.	2-3x5-10	oval	0.7-0.9x 1.4	trans. elong.	0.4x0.2	none	flat	0.2-0.4	conv. up.	complete(?)
U. of A. No. 35191	laby.or irreg.	2-10 x ?	oval	1-1.2x 1.6	trans. elong.	0.6x0.3	none	flat	0.3-0.4	conv. up.	complete(?)

Halysites [Cystihalysites] latus Tchernychev											
Fig.Spec. U. of A. No. 39194a	sub- oval, var.	av. 6 x 20	oval	av. 2.2x2.9	trans. elong.	1.1x0.6	none	flat	0.4-0.6	conv. up.	complete or vesicular
U. of A. No. 39194b	sub- oval, var.	av. 7 x 18	oval	1.9x2.9	trans. elong.	0.9x0.3	none	flat	0.4	conv. up.	complete (vesicular?) or vesicular
U. of A. No. 1130	sub-oval or sub- rect.	av. 5x15-20	oval	1.9x2.8	trans. elong.	av. 1.3x0.8	none	flat	0.6	conv. up.	complete or complete or vesicular
No. 1126	sub-oval irreg.	?	oval	av. 2.3x3	trans. elong.	1.4x0.6	none	flat	0.2-0.4	conv. up.	complete or vesicular
U. of A. ?No. 37308	sub- rect.	8-15 x 10-30	oval	1.5-1.9x 2.8	trans. elong. or para.	0.3-1.0x 0.3-0.5	none	flat	0.4	conv. up.	complete(?)

SPECIMEN NUMBER	LACUNAE		AUTOCORALLITES		MICROCORALLITES		SEPTA	AUTOCORALLITE TABULAE		MICROCORALLITE TABULAE	
	SHAPE	SIZE (mm)	SHAPE	SIZE (mm)	SHAPE	SIZE (mm)		SHAPE	SPACING (mm)	SHAPE	APPEARANCE
<u>Halysites</u> [<u>Cystihalysites</u>] <u>magnitubus</u> Buehler forma 1											
Fig. spec. No. 1127	irreg. or laby.	3-7x7- 16	oval or nearly circ.	3-3.2 x 3.7-4.0	para.	1 x 2	none	conc. up.	up to 1	conv. up.	complete or vesicular
Fig. spec. U. of A. No. 1125	irreg.	7 + x up to 65+	oval	3.2x4.1	para.	1.3x1.5	none	flat or conc. up.	0.6 - 0.8	conv. up.	complete or vesicular
<u>Halysites</u> [<u>Cystihalysites</u>] <u>mirabilis</u> Tchernychev											
Fig. spec. U. of A. No. 1191	irreg. or laby.	1-7x8- 22 +	mainly circ.	av. 1.8x2.0	trans. elong.	0.8x0.3	none	flat	0.5	conv. up.	complete or vesicular
U. of A. No. 35185	sub- rect. or irreg.	2-4x3-10	mainly circ.	av. 1.6-1.8x 1.8	trans. elong.	av. 0.8x0.2	none	flat	0.5-0.7	conv. up.	obsured ?
U. of A. No. 1133	laby. or irreg.	2-5x6-15	mainly circ.	1.1-1.6	trans. elong.	0.9x0.3	none	flat	0.1-0.3	conv. up.	complete or vesicular
U. of A. ?No. 1134	laby.	up to 1 x ?	mainly circ.	1x1-1.6	trans. elong.	0.3x0.1	none	flat	0.1-0.3	conv. up.	complete, occas. vesicular
<u>Halysites</u> [<u>Cystihalysites</u>] <u>nexus</u> Davis											
Holotype M.C.Z. No. 8785	unclosed	width up to 25	oval	1.8-2 x 2.5-3	sq. or para.	0.5-0.6x 1	none	flat	0.6-0.8	conv. up.	complete(?)

SPECIMEN	LACUNAE		AUTOCORALLITES		MICROCORALLITES		SEPTA	AUTOCORALLITE TABULAE		MICROCORALLITE TABULAE	
	SHAPE	SIZE (mm)	SHAPE	SIZE (mm)	SHAPE	SIZE (mm)		SHAPE	SPACING (mm)	SHAPE	APPEARANCE
Fig. spec. No. 1129	unclosed	3-7	oval	1.2-1.9x 1.7-2.5	trans. along.	0.7x0.5	none	flat	0.4	conv. up.	complete or vesicular
No. 1128	mainly unclosed	width from 5-12	oval	1.4x2.3	trans. along.	0.9x0.3	none	flat	0.2	conv. up.	complete (vesicu- lar?)
<u>Halysites</u> sp., cf. <u>H. catenularius</u> (Linnaeus)											
Fig. spec. No. 1189	sub- rect.or sub-oval	2.5x4-12	oval	1.4x9	sq. or para.	0.2x0.2- 0.3	none	flat	0.2-0.5	flat	complete
<u>Halysites</u> sp., cf. <u>H. süssmilchi</u> Etheridge											
Fig. spec. U. of A. No. 37276	laby. or sub-oval	1.5-4x4 12	oval	0.6-1 0.8-1.3	sq.	0.2-0.3	none	flat	0.2-0.3	flat	complete
U. of A. ?No. 1139	laby.	0.5-4x 3-18	oval	0.4-0.7x 0.8-1	sq. or para.	0.1-0.3 x0.3	none	----- destroyed -----			
U. of A. ?No. Si243	laby. or sub- polyg.	1-3x3-18	oval	0.3x0.8	sq.	0.1	none	flat	less than 1	flat	complete
No. 1135	laby.	2-4x5-12	oval occas. circ.	0.8-1x 1-1.2	sq.	0.1	none	flat	1	flat	complete
No. 1137	laby. or irreg.	1-4x5-10	oval	0.7x1	sq.	0.3	none	flat	1-2	flat	complete
No. 1136	laby. or irreg.	1-4x3- 10	oval	0.5x0.8	sq.	0.2	none	flat	1	flat	complete

SPECIMEN NUMBER	LACUNAE		AUTOCORALLITES		WALL		SEPTA	TABULAE	
	SHAPE	SIZE (mm)	SHAPE	SIZE (mm)	FREE	INTERCORALLITE (mm)		SHAPE	SPACING (mm)
<u>Catenipora gotlandica (Yabe)</u>									
Fig. spec. No. 1153	rect.	2-3x5-21	oval or circ.	2-2.3x 2-3	0.15	0.3	none	conc. up.	av. 0.5
U. of A. No. 1152	rect. or irreg.	2.6x4-25 +	oval, or nearly circ.	av. 1.6-1.9x 2-2.3	0.2	0.3	none	conc. up.	0.3
?No. 1151	rect. or irreg.	2-5x7-12	oval occas. circ.	av. 1.3x1.7 var.	0.1	0.2-0.3	none	oblit.	
U. of A. ?No. 37504	rect. or irreg.	3-5x6-15	oval	1.3-1.8x 2.4-2.8	0.2	0.4	none	oblit.	
<u>Catenipora [Quepura?] irregularis (Teichert)</u>									
Fig. spec. No. 1128	mainly sq.	less than 1	oval, circ. ang.	1-1.5	0.1	0.2	none	flat or conc. up.	0.2-0.4
No. 1140	sq.	2	mainly ang.	1.5-2	0.1	0.1-0.2	none	flat	0.5
<u>Catenipora [Quepura] n. sp. 1</u>									
Fig. spec. U. of A. No. 1150	mainly rect.	2-3x5-13	oval	1-1.2x 1.4-2	0.2-0.3	0.3	none	flat	0.3

(C. n. sp. 1, cont'd)

SPECIMEN NUMBER	LACUNAE		AUTOCORALLITES		WALL		SEPTA	TABULAE	
	SHAPE	SIZE(mm)	SHAPE	SIZE(mm)	FREE	INTERCORALLITE (mm)		SHAPE	SPACING(mm)
No. 1128	rect.or irreg.	mainly 1-2x5	oval	1-1.6x 1.9	0.1- 0.2	0.3-0.5	none	flat	0.3
Fig. of A. No. 35185	sub- rect.	1-5x5-10	oval	1.3-1.8 x2.1	0.2	0.2-0.4	none	flat	0.2
<u>Catenipora [Quepura] n. sp. 1 forma 1</u>									
Fig. spec. U. of A. No. 1161	polyg. or rect.	av. 5x8	oval	1x1.8-2	0.2	0.3-0.4	none	flat or conc.up.	0.4
No. 1164	rect.	av. 5x8	oval	0.9x1.7	0.1	0.2-0.3	none	flat	0.3-0.5
No. 1162	rect.to sub- triang.	3-7x7-12	oval	0.9-1.4x 1.7-2	0.2-0.3	0.4-0.7	none	mainly obliterated (flat?)	
No. 1167	sub- polyg. or laby.	av. 5x10	oval	1x1.9	0.2	0.4-0.6	none	conc. up.	av. 0.2
?No. 1163	rect.or laby.	2-5x5-15	oval	0.8-1x 1.8x2.3	0.1-0.2	0.3-0.5	none	flat	0.2-0.3
<u>Catenipora sp., cf. C. [Quepura] pulchella (Wilson)</u>									
Fig. spec. No. 1157	laby.or irreg.	3-4x10	oval	av. 0.6x1	0.1- 0.25	0.2	none	flat	0.2

(C. sp., cf. C. pulchella, cont'd)

SPECIMEN NUMBER	LACUNAE		AUTOCORALLITES		WALL		SEPTA	TABULAE	
	SHAPE	SIZE (mm)	SHAPE	SIZE (mm)	FREE	INTERCORALLITE (mm)		SHAPE	SPACING (mm)
No. 1159	irreg. or laby.	2-6x3- 16	oval	0.8x1.4	0.2	0.4-0.7	none	obliterated	
?No. 1160	irreg. or laby.	1-4x5-14	oval	1x1.4	0.1	0.4	none	obliterated	
?No. 1156	irreg.	2 x 7	oval	0.7x1	0.1	0.2-0.4	none	flat	0.1
No. 1170	laby. or irreg.	1-5x6- 20	oval	0.8-1x 1-1.4	0.1- 0.2	0.2-0.4	none	flat	0.2

Catenipora sp., cf. C. [Quepura] simplex (Lambe)

Fig. spec. No. 1166	mainly laby.	1.5-5x 6-20	oval	1.2x1.9	0.1- 0.2	0.3	none	mainly conc.up.	
U. of A. No. 35507	laby.	1-5x6- 21	oval	av. 1.3x1.8	0.1- 0.2	0.1	none	flat	0.2
?No. 1135	laby.or irreg.	1-5x6- 25	oval	1x1.7	0.1- 0.2	?	none	obliterated	
No. 1168	laby.	2x12-18	oval	1-1.5x 1.7	0.2- 0.4	0.2	none	obliterated	

SPECIMEN NUMBER	LACUNAE		AUTOCORALLITES		WALL		SEPTA	TABULAE	
	SHAPE	SIZE (mm)	SHAPE	SIZE (mm)	FREE	INTERCORALLITE (mm)		SHAPE	SPACING (mm)
<u>Catenipora [Quepora] sp. A.</u>									
Fig. spec. U. of A. No. 35183	often unclosed	2-3x 8-60+	oval	av. 0.9x1.7	0.2-0.3	0.3	none	flat	0.2-0.4
<u>Catenipora [Quepora?] sp. B.</u>									
Fig. spec. U. of A. No. 1158	rect.	1 x 4	oval	0.7x1.2	0.1	0.2	none	oblit.	
<u>Catenipora [Quepora] sp. C.</u>									
Fig. spec. U. of A. No. 615	small	0-3x0-7	oval	0.8-1x 1.2-1.6	0.2	0.2-0.6	none	flat	0.4
No. 1127	laby. very small	0-4x0-10	oval	0.9x1.8	0.2	0.4	none	flat	0.1-0.2

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